PHYSICO-CHEMICAL TABLES

FOR THE USE OF

ANALYSTS, PHYSICISTS, CHEMICAL MANUFACTURERS, AND SCIENTIFIC CHEMISTS.

IN TWO VOLUMES, EACH COMPLETE IN ITSELF.

BY

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PUBLISHERS' NOTE.

WITH the present volume of "Physico-Chemical Tables," which contains the concluding portions of the Tables of Physical Chemistry, the commencement of which will be found in Volume I., together with a valuable and exhaustive series of tables specially applicable to the operations of analytical chemistry, the work of the late John Castell-Evans is brought to a close.

The work in its present form may be regarded as a fitting monument to the energy, perseverance, and deep devotion of the author, who has not, unhappily, been spared to reap that harvest of gratitude which his labours have so truly merited from those who, like himself, have engaged in the furtherance of the Exact Sciences. But the work itself is a tangible record of the minute pains which the Author so assiduously brought to bear upon his life's work, and which shed lustre upon the College he so worthily served.

In a collection of tables of this nature it is almost inevitable that the individual worker in any special branch of applied chemistry will find much for which he may have no immediate or apparent use. On the other hand, it is seldom that, in compilations of this nature, even the individual worker can hope to find all that he requires. The aim of the Author of the present work has throughout been to provide not only every requisite for those engaged in the industrial applications of any given department of chemistry, but to supply the data required in *all* those departments, and to supply them thoroughly. From this point of view, the two volumes which constitute the present work may be regarded as absolutely unique.

It is at once the triumph of science and the despair of its votaries that the vast progress made from year to year, and, indeed, almost from day to day, soon renders the theories of yesterday obsolete and challenges the most careful investigations and calculations of the past. The physical constants, the atomic weights, and the fundamental units upon which all accurate calculations must necessarily be based, are at all times undergoing minute and painstaking revision by experts who bring to the elucidation of the problems involved the newer methods and the most accurate appliances which the progress of science has placed at their disposal. The process of revision tends always towards perfection, and the data now placed in the hands of scientific workers are

believed to be as near perfection as time and circumstances will allow, the investigations of the leading scientists all over the world and the results of the most recent physical and chemical investigation having been laid under contribution in order to secure that accuracy and precision which alone can justify the existence of a work of this nature. Indeed, so careful was the Author to ensure that his work should possess the utmost degree of accuracy, that he was, to the last, engaged in the recalculation of numerous tables which had appeared in the earlier volume, in the light of later research; and in the Supplementary Tables which appear at the end of the present volume will be found all the material necessary for bringing the numerical results into accordance with the "Orders in Council" and the Regulations issued by the Board of Trade as recently as March 1907.

Of the value of the work as a whole there can be no two opinions. The tables now collected together in handy compass and arranged so that the maximum convenience of reference in their consultation has been attained, are at once more numerous and more copious than any similar collection of tables previously published, while their selection and arrangement has been such as to render the invaluable data they contain most readily accessible. The Publishers venture, therefore, to hope that the welcome accorded the earlier volume may be extended to the present volume, and that those for whom the work has been prepared will find it of such general use and assistance that it may be truly felt, by all concerned, that the labours of the late distinguished author have not been in vain.

NOTES ON THE USE AND APPLICATION OF THE MOST IMPORTANT TABLES.

PART III.—PHYSICS—*continued.*

Table LXX. — Molecular Dynamics.

In this table will be found all the data necessary for the calculation of the volumes and pressures of gases by formulæ which combine Charles' or Boyle's law and Gay-Lussac's law, and are the outcome of Avogadro's original hypothesis respecting the relation of the number of gaseous molecules to the volumes they occupy.

The succeeding table, LXXa., gives values of U and P for various gases, and is followed by data relating to molecular speeds, according to Meyer. Table LXXe. deals with the subject of the speed of sound waves in a medium, and is followed by tables which give the speed of sound in gases, in liquids, in solutions and mixed liquids, in solids, and in dry air.

Table LXXii. gives the values of N for simple liquids, and embodies the figures for a large number of organic liquids, the values of mixed liquids and solutions being further continued in Tables LXXii.2, LXXii.3, 3a, 3b, 3c, 3d, and 3e.

The absolute viscosities of water, alcohol, and bromine are made the subjects of the next three tables, and the specific viscosities of a large number of compounds are given in the remaining tables relating to this section. The molecular volumes of liquids are given in Table LXXp.

Table LXXI.—Capillarity and Surface Tension.

This is the commencement of a series of tables relating to capillarity and surface tension, including the capillarity constants of water, alcohol, benzol, acetone, carbon disulphide, and ether, and the surface tension of the first four substances. These tables are amplified in LXXIe. for a number of other substances, whilst the relations between surface tension and temperature will be found in Table LXXIf. The surface tension of solids, given in a short table

relating to Laplace and Van der Waall's constants will be found in Tables LXXIs. and LXXIt.

Table LXXII.—Physical Properties of Solutions.

The next series of tables gives the physical properties of solutions, and is distributed into sub-tables, giving the boiling points and concentration of aqueous solutions, the vapour tension and boiling points of aqueous solutions of glycerol, and comprehensive specific gravity tables of ammonia solutions and solutions of the caustic alkalies, carbonates, and commercial acids, followed by tables of specific gravities of the solutions most commonly employed in chemical operations. These tables will be found exceedingly useful in chemical works and in dye works or bleaching establishments.

The solubility of gases will be found in Table LXXIII.

Table LXXIV.—Molecular Weights.

The various methods of ascertaining molecular weights have been given at considerable length, including the cryoscopic method, the boiling method, and the distillation of mixed liquids. The tables will be found exceedingly useful for those engaged in the atomic weight determinations and the observation of paper densities.

PART IV.—ANALYTICAL CHEMISTRY.

In the tables given in this, the concluding portion of the work, the values of the atomic weights adopted in the calculations are those of the International Committee, as issued in 1904, and for all ordinary purposes these may be regarded as substantially correct.

Table LXXV. may be commended to the use of analysts, as by its means they will be able to compute the results of the weighing in of the end-products of gravimetric methods by a simple inspection of the columns. The list of factors includes nearly every substance likely to be required in analytical operations, the logarithms and the factors being, in every case, given to seven figures. The table covers forty-two pages and is for use in volumetric analysis. The remaining tables of this series are applicable to gas and water analysis, to acidimetry, alcoholometry, and all the ordinary volumetric operations.

Table LXXVI. will be found useful in breweries and distilleries, as well as in the laboratories of public analysts and in those used for excise work, as they give extensive readings of the alcoholometer and figures for the dilution of alcohol, with the estimation for specific gravity of aqueous solutions. The mass and volume of absolute alcohol between 0 and 20 degrees C., as calculated by Winkler and Mendelejeff respectively, are given in the concluding tables of this series.

Tables LXXVII. and LXXVIII. These tables give the weight of various substances in various aqueous solutions, and will be found useful in local analysis and for the purposes of the physiological laboratory.

SUPPLEMENTARY TABLES.

The Supplementary Tables give a recalculation of weights and measures in accordance with the "Orders in Council" and Regulations issued by the Board of Trade in March 1907. As these figures supersede those given on pages 48–53, Vol. I., careful note should be taken in all calculations requiring extreme accuracy to substitute the latter and more authoritative values

CONTENTS.

PART III.—PHYSICS—*continued.*

PART IV.—ANALYTICAL CHEMISTRY.

PART III.—PHYSICS.—*Continued.*

TABLE LXX.—Molecular Dynamics, Kinetic Theory of Gases, etc

If P denote the pressure per unit area in dynes,
V ,, volume of gas in centimetre cubes,
m ,, mass of each individual molecule in grammes,
U ,, mean velocity of molecules in centimetres per second,
N ,, number of individual molecules in V cm. cubes of the gas.

$$P = \frac{NmU^2}{3V}$$

or putting $n = \frac{N}{V}$ = number of molecules in 1 cm. cube,

and $\rho = nm$ = mass of 1 cm. cube of the gas,

$$P = \frac{1}{3}\rho U^2$$

and $U^2 = \frac{3P}{\rho}$ or $U = \sqrt{3P/\rho}$.

For all gases $T \propto \frac{mU^2}{2}$

that is, at the same temperature the mean kinetic energy of molecular agitation is practically the same for all gases: or

$$m_1 U_1^2 = m_2 U_2^2 = m_3 U_3^2 = \text{etc.}$$

Under the same pressure we have—

$$P = \frac{N_1 m_1 U_1^2}{3V_1} = \frac{N_2 m_2 U_2^2}{3V_2} = \frac{N_3 m_3 U^2}{3V_3} = \text{etc.}$$

e temperature, $m_1U_1^2/3 = m_2U_2^2/3 = m_3U_3^2/3$,

$$\text{therefore } \frac{N_1}{V_1} = \frac{N_2}{V_2} = \frac{N_3}{V_3} = \text{etc.}$$

$= V_3 = \text{etc.}$

$$\text{we get } N_1 = N_2 = N_3 = \text{etc.}$$

dro's law that "under like conditions as to temperature and pressure, equal
n the same number of gaseous molecules."

rmodynamic scale of absolute temperature we get—

$$T = rmU^2 \text{ and } mU^2 = \frac{T}{r}$$

$$\therefore P = \frac{N}{3r} \cdot \frac{T}{V} \qquad \text{that is } PV = \frac{N}{3r} \cdot T$$

$$\text{or putting } \frac{N}{3r} = R, \text{ we get } PV = RT,$$

onstant.

w.—When T is constant $PV = \frac{R}{T} = R_1$ a constant, or the volume varies
pressure.

's Law.—When P is constant $\frac{V}{T} = \frac{R}{P} = R_2$ a constant, *i.e.*, the volume varies
absolute temperature.

uations we virtually consider the molecules as mere points, having each a
out practically occupying no space; the deductions are therefore only
to the truth.

XXa. in columns 4 and 6 on pp. 553–4, 𝔙 denotes the volume in litres of a
, gramme molecule; in the corresponding columns on pp. 555–6 the same
he volume in cubic feet of a British mol, *i.e.*, a pound-molecule Avoirdupois.

(C.R. cxiii. 186) the following values of 𝔙 under 760 mms.—

For hydrogen,	22·41	litres
,, oxygen,	22·39	,,
,, nitrogen,	22·34	,,
Mean value,	22·38	,,

giving $R = 0{\cdot}0819$.

under 760 mms. at 0° C. we get from the data given on p. 308, *ante*, the
for V :—

For air	V = 0·7732768	litres
,, hydrogen	V = 11·1279266	,,
,, oxygen	V = 0·6997930	,,

So when P is given in grammes per centimetre square and V in litres, we have for 1 grm. of air at 0° C.—

$$PV = 1033{\cdot}2428 \times 0{\cdot}7732768 \text{ litres}$$
$$= 798{\cdot}982677$$

When P is given in dynes per cm^2., $PV = 783476{\cdot}7287$

Taking 0° C. = 273° on the absolute thermodynamic scale of temperature we get for 1 grm. of air (V being expressed in litres)—

P expressed in	atmospheres,	$R = 0{\cdot}0028325$
,,	mms. of Hg,	$R = 2{\cdot}1527119$
,,	grms. per cm^2.,	$R = 2{\cdot}9266765$
,,	dynes per cm^2.,	$R = 2869{\cdot}8781272$

and for 1 grm. of hydrogen —

P expressed in	atmospheres,	$R = 0{\cdot}0407616$
,,	mms. of Hg,	$R = 30{\cdot}9788434$
,,	grms. per cm^2.,	$R = 42{\cdot}1166670$
,,	dynes per cm^2.,	$R = 41299{\cdot}3039973$

and for 1 grm. of oxygen—

P expressed in	atmospheres,	$R = 0{\cdot}002563344$
,,	mms. of Hg,	$R = 1{\cdot}948141688$
,,	grms. per cm^2.,	$R = 2{\cdot}648557070$
,,	dynes per cm^2.,	$R = 2597{\cdot}15621928$

For an ideal gas 1 grm. of which, at 0° C. under a pressure of 760 mms. of mercury, would occupy exactly one litre, we have—

P expressed in	atmospheres,	$R = 0{\cdot}003663$
,,	mms. of Hg,	$R = 2{\cdot}783882$
,,	grms. per cm^2.,	$R = 3{\cdot}7847721611$
,,	dynes per cm^2.,	$R = 3711{\cdot}3206544176$

For an ideal gas 1 grm. of which, at 0° C. under a pressure of 1 metre of Hg, occupies one litre, we have—

P expressed in	atmospheres,	$R = 0{\cdot}00278388$
,,	mms. of Hg,	$R = 2{\cdot}1157509157$
,,	grms. per cm^2.,	$R = 2{\cdot}8764268425$
,,	dynes per cm^2.,	$R = 2820{\cdot}6036973574$

If R_a denote the value of R for any gas A under any given conditions, and R_b the value for any other gas B under the same conditions, then $R_b = R_a/\triangle$ where—

$$\triangle = \frac{\text{mass of 1 litre of B}}{\text{mass of 1 litre of A}}.$$

Nernst gives—

$$C_p - C_v = \frac{PV}{T} = R \text{ in calories};$$

where C_p = molecular heat of gas under constant pressure, and
C_v = ,, ,, at constant volume.

1 'litre-atmosphere' = 1033000 c.grm. units of works
= (1033000/42750) calories = 24·17 calories

and as $R = 0{\cdot}0819$ litre-atmosphere, he gets $R = 1{\cdot}980$ calories = 2 calories very nearly.

Ostwald gets $C_p - C_v = 84688$ c.grm. units of work, and $84688/42355 = 2$ calories very nearly.

These values work out a little different when the most recent values are taken for the weights of the various gases and for J: thus for oxygen we get

$$\begin{aligned} C_p - C_v &= 84119 \text{ c.grm. units of work} \\ J &= 42740 \quad ,, \quad ,, \\ (C_p - C_v)/J &= 1{\cdot}963 \text{ calories} \end{aligned}$$

so for all ordinary gases and for a large number of vapours the approximation 2 calories is considerably too high.

In the Table LXXA. the values of R for Fahrenheit temperatures can be easily calculated from those given by simply multiplying by 5/9, *i.e.*,

$$R_F = R_C\left(\frac{1}{2} + \frac{1}{9} \text{ of } \frac{1}{2}\right).$$

Thus, R_C for hydrogen $= 0{\cdot}08152$ under one atmosphere.

$$\frac{1}{2} \text{ of } 0{\cdot}08152 = 0{\cdot}04076$$

$$\frac{1}{6} \text{ of } 0{\cdot}04076 = \quad 00453 \text{ very nearly}$$

$$\therefore R_F \qquad = 0{\cdot}04529.$$

In the table the standard of molecular weights has been taken as $H_2 = 2$; the values of $\mathfrak{V}$ and R for the standard $O_2 = 32$ can be easily calculated by multiplying those in the table by $\frac{32}{31{\cdot}76} = \frac{400}{397} = 1{\cdot}007556675$. Putting V_H for value corresponding to $H_2 = 2$, and V_O for value corresponding to $O_2 = 32$, we get

$$V_O = V_H + A + B + C + D + E + F$$

where $A = V_H \div 150$, $B = A \div 8$, $C = B \div 15$, $D = C \div 50$, $E = D \div 140$, and $F = E \div 18$.

Thus for $\mathfrak{V}$ under 1 grm. per cm^2. we get

$$\begin{aligned} V_H &= 22995{\cdot}7 \\ A &= \quad 153{\cdot}3 \\ B &= \quad\ \ 19{\cdot}2 \\ C &= \quad\ \ \ 1{\cdot}3 \\ \hline \therefore V^O &= 23169{\cdot}5 \end{aligned}$$

The instances in which it will be found necessary to proceed beyond C will be very few.

TABLE LXXA.—Values of $\mathfrak{V}$ and R for various Gases.

Substance.			P in Atmospheres 760 mms. of Hg.		P in Metres of Ice-cold Hg.	
Name.	Formula.	Molec. Weight.	$\mathfrak{V}$	R	$\mathfrak{V}$	R
Hydrogen, ...	H_2	2·00	22·2559	0·08152	16·9144	0·06196
Nitrogen, ...	N_2	27·86	22·1550	08115	16·8378	06168
Oxygen, ...	O_2	31·76	22·2256	08141	16·8915	06189
Fluorine, ...	F_2	37·70	23·1369	08475	17·5840	06441
Chlorine, ...	Cl_2	70·36	21·8909	08019	16·6371	06094
Hydrogen fluoride, ...	HF	19·85	21·5402	07890	16·3705	05997
Carbon monoxide, ...	CO	27·79	22·2046	08134	16·8755	06181
Nitric oxide, ...	NO	29·81	22·1861	08127	16·8614	06176
Hydrogen chloride, ...	HCl	36·18	22·2748	08159	16·9388	06205
Hydrogen bromide, ...	HBr	80·36	22·7538	08335	17·2929	06334
Hydrogen iodide, ...	HI	126·90	22·1360	08108	16·8234	06162
Hydrogen sulphide, ...	H_2S	33·82	21·9379	08036	16·6728	06107
Carbon dioxide, ...	CO_2	43·67	22·0855	08090	16·7850	06148
Nitrous oxide, ...	N_2O	43·74	20·9561	07676	15·9266	05834
Carbonyl sulphide, ...	COS	59·61	21·9021	08023	16·6456	06097
Sulphur dioxide, ...	SO_2	63·58	21·5920	07909	16·4099	06011
Nitrosyl chloride, ...	NOCl	64·99	21·7555	07969	16·5342	06058
Chlorine peroxide, ...	ClO_2	66·94	22·2159	08138	16·8841	06185
Hydrogen selenide, ...	H_2Se	80·80	22·3545	08188	16·9894	06223
Chlorine monoxide, ...	Cl_2O	86·24	22·1767	08123	16·8543	06174
Hydrogen telluride, ...	H_2Te	128·04	22·0562	08079	16·7627	06140
Ammonia, ...	NH_3	16·93	22·1854	08126	16·8609	06176
Acetylene, ...	C_2H_2	25·82	21·7022	07950	16·4937	06042
Phosphine, ...	PH_3	33·82	21·5422	07891	16·3721	05997
Cyanogen, ...	C_2N_2	51·72	22·1401	08110	16·8265	06164
Boron trifluoride, ...	BF_3	67·47	22·5623	08264	17·0473	06244
Arsine, ...	AsH_3	77·43	22·1981	08131	16·8705	06180
Phosphorus trifluoride, ...	PF_3	87·37	22·3565	08189	16·9909	06224
Carbonyl chloride, ...	$COCl_2$	98·15	21·6540	07932	16·4570	06028
Marsh gas, ...	CH_4	15·91	22·0639	08082	16·7686	06142
Methyl fluoride, ...	CH_3F	33·76	21·3981	07838	16·2625	05968
Methyl chloride, ...	CH_3Cl	50·09	22·3763	08196	17·0060	06229
Methylene fluoride, ...	CH_2F_2	51·61	22·0491	08077	16·7573	06138
Silicon tetrafluoride, ...	SiF_4	103·58	22·2489	08150	16·9092	06194
Phosphorus oxyfluoride, ...	POF_3	103·25	21·6959	07947	16·4989	06044
Ethylene, ...	C_2H_4	27·82	21·8357	07998	16·5952	06078
Phosphorus pentafluoride, ...	PF_5	125·07	21·5398	07890	16·3703	05996
Phosphorus chlor-fluoride, ...	PCl_2F_3	157·67	22·5783	08271	17·1595	06286
Methyl amine, ...	NH_2CH_3	30·84	22·0814	08088	16·7818	06147
Allylene, ...	C_3H_4	39·73	22·2319	08144	16·8963	06189
Ethane, ...	C_2H_6	29·82	21·4503	07857	16·3023	05972
Ethyl fluoride, ...	C_2H_5F	47·67	21·6836	08053	16·4795	06036
Ethyl chloride, ...	C_2H_5Cl	64·00	22·3027	08169	16·9501	06209
Propylene, ...	C_3H_6	41·73	21·5413	07891	16·3714	05997
Methyl ether, ...	$(CH_3)_2O$	45·70	21·8545	08005	16·6094	06084
Ethyl amine, ...	$NH_2C_2H_5$	44·75	22·0016	08059	16·7212	06125
Butylene, ...	C_4H_8	55·64	22·2364	08145	16·8996	06190
Butane, ...	C_4H_{10}	57·64	22·1750	08123	16·8530	06173
Butyl fluoride, ...	$C_4H_9F_5$	75·49	22·6258	08288	17·1956	06299

TABLE LXXa.—*continued.*

Substance.			P in Grammes per cm. Square.		P in Mega-dynes per cm. Square.	
Name.	Formula.	Molec. Weight.	W	R	W	R
Hydrogen,	H_2	2·00	22995·7	84·2333	22·5628	0·08265
Nitrogen,	N_2	27·86	22891·5	83·8516	22·1606	08227
Oxygen,	O_2	31·76	22964·4	84·1187	22·5322	08254
Fluorine,	F_2	37·70	23906·2	87·5685	23·4561	08592
Chlorine,	Cl_2	70·36	22618·7	82·8521	22·1929	08129
Hydrogen fluoride,	HF	19·85	22256·3	81·5249	21·8373	07999
Carbon monoxide,	CO	27·79	22942·7	84·0392	22·5108	08246
Nitric oxide,	NO	29·81	22923·7	83·9696	22·4921	08239
Hydrogen chloride,	HCl	36·18	22995·3	84·2319	22·5820	08272
Hydrogen bromide,	HBr	80·36	23510·2	86·1179	23·0676	08150
Hydrogen iodide,	HI	126·90	22871·9	83·7798	22·4413	08220
Hydrogen sulphide,	H_2S	33·82	22663·9	83·0179	22·2405	08147
Carbon dioxide,	CO_2	43·67	22819·7	83·5886	22·3902	08201
Nitrous oxide,	N_2O	43·74	21652·7	79·3139	21·2451	07782
Carbonyl sulphide,	COS	59·61	22630·3	82·8945	22·2042	08133
Sulphur dioxide,	SO_2	63·58	22309·8	81·7209	21·8898	08018
Nitrosyl chloride,	$NOCl$	64·99	22478·7	82·3396	22·0556	08079
Chlorine peroxide,	ClO_2	66·94	22954·5	84·0824	22·5221	08250
Hydrogen selenide,	H_2Se	80·80	23097·6	84·6066	22·6628	08301
Chlorine monoxide,	Cl_2O	86·24	22913·9	83·9337	22·4825	08234
Hydrogen telluride,	H_2Te	128·04	22789·4	83·4777	22·3604	08191
Ammonia,	NH_3	16·93	22922·9	83·966[illegible]	22·4914	08239
Acetylene,	C_2H_2	25·82	22423·6	82·1308	22·0015	08059
Phosphine,	PH_3	33·82	22258·3	81·5322	21·8393	08000
Cyanogen,	C_2N_2	51·72	22876·1	83·7952	22·4455	08222
Boron trifluoride,	BF_3	67·47	23312·3	85·3930	22·8735	08386
Arsine,	AsH_3	77·43	22936·0	84·0147	22·5042	08243
Phosphorus trifluoride,	PF_3	87·37	23099·6	84·6139	22·6618	08302
Carbonyl chloride,	$COCl_2$	98·15	22373·8	81·9553	21·9526	08041
Marsh gas,	CH_4	15·91	22797·4	83·5070	22·1287	08106
Methyl fluoride,	CH_3F	33·76	22109·4	80·9868	21·6933	07946
Methyl chloride,	CH_3Cl	50·09	23120·2	84·6894	22·6850	08309
Methylene fluoride,	CH_2F_2	51·61	22782·1	83·4507	22·3532	08188
Silicon tetrafluoride,	SiF_4	103·58	22988·5	84·2070	22·5558	08262
Phosphorus oxyfluoride,	POF_3	103·25	22417·1	82·1139	21·9951	08057
Ethylene,	C_2H_4	27·82	22561·6	82·6132	22·1369	08109
Phosphorus pentafluoride,	PF_5	125·07	22255·9	81·5234	21·8369	07999
Phosphorus chlor-fluoride,	PCl_2F_3	157·67	23328·8	85·4535	22·8897	08384
Methyl amine,	NH_2CH_3	30·84	22815·4	83·5729	22·3859	08200
Allylene,	C_3H_4	39·73	22971·0	84·1429	22·5386	08256
Ethane,	C_2H_6	29·82	22163·4	81·1846	21·7462	07966
Ethyl fluoride,	C_2H_5F	47·67	22404·4	82·0674	21·9827	08032
Ethyl chloride,	C_2H_5Cl	64·00	23044·1	84·4107	22·6103	08282
Propylene,	C_3H_6	41·73	22257·4	81·5289	21·8384	07999
Methyl ether,	$(CH_3)_2O$	45·70	22581·0	82·7144	22·1560	08116
Ethyl amine,	$NH_2C_2H_5$	44·75	22733·0	83·2711	22·3051	08170
Butylene,	C_4H_8	55·64	22975·6	84·1596	22·5431	08242
Butane,	C_4H_{10}	57·64	22912·1	83·9272	22·1808	08235
Butyl fluoride,	$C_4H_9F_5$	75·49	23578·0	86·3663	22·9371	08402

TABLE LXXa.—*continued.*

Substance.			P in Atmospheres 30 Inches of Hg.		P in Inches of Ice-cold Hg.	
Name.	Formula.	Molec. Weight.	𝔗	R	𝔗	R
Hydrogen,	H_2	2·00	355·581	1·30249	10667·4	39·0747
Nitrogen,	N_2	27·86	353·969	29659	10619·1	38·8978
Oxygen,	O_2	31·76	355·097	30072	10652·9	39·0216
Fluorine,	F_2	37·70	369·658	36175	11089·7	40·6216
Chlorine,	Cl_2	70·36	349·751	28114	10492·5	38·4341
Hydrogen fluoride,	HF	19·85	344·147	26061	10324·4	37·8183
Carbon monoxide,	CO	27·79	354·761	29949	10642·8	38·9846
Nitric oxide,	NO	29·81	354·467	29841	10634·0	38·9524
Hydrogen chloride,	HCl	36·18	355·884	30360	10676·5	39·1081
Hydrogen bromide,	HBr	80·36	363·536	33163	10906·1	39·9491
Hydrogen iodide,	HI	126·90	353·606	29526	10608·2	38·8579
Hydrogen sulphide,	H_2S	33·82	350·502	28389	10515·0	38·5165
Carbon dioxide,	CO_2	43·67	352·860	29253	10585·8	38·7758
Nitrous oxide,	N_2O	43·74	334·831	22638	10044·9	36·7868
Carbonyl sulphide,	COS	59·61	349·929	28179	10497·9	38·4538
Sulphur dioxide,	SO_2	63·58	344·974	26364	10349·2	37·8322
Nitrosyl chloride,	$NOCl$	64·99	347·587	27321	10427·6	38·1963
Chlorine peroxide,	ClO_2	66·94	354·943	30016	10618·3	39·0048
Hydrogen selenide,	H_2Se	80·80	357·157	30827	10714·7	39·2480
Chlorine monoxide,	Cl_2O	86·24	354·315	29786	10629·5	38·9359
Hydrogen telluride,	H_2Te	128·04	352·391	29081	10571·7	38·7242
Ammonia,	NH_3	16·93	354·453	29836	10633·6	38·9509
Acetylene,	C_2H_2	25·82	346·735	27009	10402·0	38·1026
Phosphine,	PH_3	33·82	344·179	26073	10325·4	37·8220
Cyanogen,	C_2N_2	51·72	353·731	29572	10611·9	38·8714
Boron trifluoride,	BF_3	67·47	360·476	32042	10814·3	39·4590
Arsine,	AsH_3	77·43	354·658	29911	10639·7	38·9733
Phosphorus trifluoride,	PF_3	87·37	357·188	30838	10715·6	39·2513
Carbonyl chloride,	$COCl_2$	98·15	345·964	26881	10378·9	38·0179
Marsh gas,	CH_4	15·91	352·514	29126	10575·4	38·7377
Methyl fluoride,	CH_3F	33·76	341·877	25230	10256·3	37·5689
Methyl chloride,	CH_3Cl	50·09	357·506	30954	10725·2	39·2864
Methylene fluoride,	CH_2F_2	51·61	352·277	29039	10568·3	38·7117
Silicon tetrafluoride,	SiF_4	103·58	355·470	30209	10664·1	39·0626
Phosphorus oxyfluoride,	POF_3	103·25	346·634	26972	10399·0	38·0916
Ethylene,	C_2H_4	27·82	348·869	27791	10466·1	38·3374
Phosphorus pentafluoride,	PF_5	125·07	344·141	26059	10324·2	37·8176
Phosphorus chlor-fluoride,	PCl_2F_3	157·67	360·732	32136	10821·9	39·6407
Methyl amine,	NH_2CH_3	30·84	352·793	29220	10583·8	38·7685
Allylene,	C_3H_4	39·73	355·198	30109	10625·9	38·9227
Ethane,	C_2H_6	29·82	342·711	25535	10281·3	37·6604
Ethyl fluoride,	C_2H_5F	47·67	346·438	26900	10393·1	38·0700
Ethyl chloride,	C_2H_5Cl	64·00	356·350	30523	10689·9	39·1569
Propylene,	C_3H_6	41·73	344·164	26068	10324·9	37·8202
Methyl ether,	$(CH_3)_2O$	45·70	349·169	27901	10475·1	38·3702
Ethyl amine,	$NH_2C_2H_5$	44·75	351·519	28767	10545·6	38·6301
Butylene,	C_4H_8	55·64	355·268	30135	10658·0	39·0405
Butane,	C_4H_{10}	57·64	354·288	29776	10628·6	38·9328
Butyl fluoride,	$C_4H_9F_5$	75·49	361·492	32415	10844·8	39·7244

TABLE LXXA.—*continued.*

Substance.			P in Pounds per Inch Square.		P in Poundals per Inch Square.	
Name.	Formula.	Molec. Weight	𝔗	R	𝔗	R
Hydrogen,	H_2	2·00	5329·28	19·1915	168561	617·439
Nitrogen,	N_2	27·86	5215·54	19·1045	167797	610·795
Oxygen,	O_2	31·76	5232·16	19·1654	168332	616·601
Fluorine,	F_2	37·70	5446·70	19·9513	175234	641·883
Chlorine,	Cl_2	70·36	5153·38	18·8768	165797	607·315
Hydrogen fluoride,	HF	19·85	5070·81	18·5744	163141	597·586
Carbon monoxide,	CO	27·79	5227·21	19·1473	168172	616·015
Nitric oxide,	NO	29·81	5222·87	19·1314	168033	615·505
Hydrogen chloride,	HCl	36·18	5243·75	19·2079	168704	617·963
Hydrogen bromide,	NBr	80·36	5356·51	19·6209	172332	631·253
Hydrogen iodide,	HI	126·90	5210·18	19·0849	167625	614·011
Hydrogen sulphide	H_2S	33·82	5164·44	18·9174	166153	608·619
Carbon dioxide,	CO_2	43·67	5199·19	19·0447	167271	612·714
Nitrous oxide,	N_2O	43·74	4933·54	18·0716	158724	581·363
Carbonyl sulphide,	COS	59·61	5156·01	18·8865	165882	607·626
Sulphur dioxide,	SO_2	63·58	5082·90	18·6187	163583	599·022
Nitrosyl chloride,	$NOCl$	64·99	5121·50	18·7601	164771	603·557
Chlorine peroxide,	ClO_2	66·94	5229·89	19·1517	168259	616·333
Hydrogen selenide,	H_2Se	80·80	5262·50	19·2755	169308	620·176
Chlorine monoxide,	Cl_2O	86·24	5220·64	19·1452	167962	615·245
Hydrogen telluride,	H_2Te	128·04	5192·23	19·0192	167050	611·905
Ammonia,	NH_3	16·93	5222·67	19·1307	168026	615·480
Acetylene,	C_2H_2	25·82	5108·94	18·7141	164367	602·077
Phosphine,	PH_3	33·82	5071·28	18·5761	163156	597·641
Cyanogen,	C_2N_2	51·72	5212·03	19·0917	167684	614·227
Boron trifluoride,	BF_3	67·47	5311·42	19·4558	170882	625·941
Arsine,	AsH_3	77·43	5225·68	19·1417	168123	615·835
Phosphorus trifluoride,	PF_3	87·37	5262·97	19·2783	169323	620·231
Carbonyl chloride,	$COCl_2$	98·15	5097·59	18·6725	163955	600·568
Marsh gas,	CH_4	15·91	5194·10	19·0260	167107	612·114
Methyl fluoride,	CH_3F	33·76	5037·34	18·4518	162065	598·645
Methyl chloride,	CH_3Cl	50·09	5267·65	19·2954	169473	620·780
Methylene fluoride,	CH_2F_2	51·61	5190·61	19·0132	166995	611·703
Silicon tetrafluoride,	SiF_4	103·58	5237·65	19·1855	168508	617·245
Phosphorus oxyfluoride,	POF_3	103·25	5107·46	18·7086	164320	602·015
Ethylene,	C_2H_4	27·82	5130·38	18·7924	165379	605·784
Phosphorus pentafluoride,	PF_5	125·07	5070·72	18·5741	163138	597·590
Phosphorus chlor-fluoride,	PCl_2F_3	157·67	5315·18	19·4695	171003	626·385
Methyl amine,	NH_2CH_3	30·84	5198·21	19·0411	167249	612·634
Allylene,	C_3H_4	39·73	5218·91	19·1169	167906	615·040
Ethane,	C_2H_6	29·82	5049·66	18·4969	162460	595·092
Ethyl fluoride,	C_2H_5F	47·67	5104·57	18·6981	164227	601·564
Ethyl chloride,	C_2H_5Cl	64·00	5250·32	19·2319	168916	618·739
Propylene,	C_3H_6	41·73	5071·07	18·5534	163149	597·615
Methyl ether,	$(CH_3)_2O$	45·70	5144·81	18·8454	165521	606·305
Ethyl amine,	$NH_2C_2H_5$	44·75	5179·43	18·9723	166635	610·386
Butylene,	C_4H_8	55·64	5234·68	19·1746	168413	616·896
Butane,	C_4H_{10}	57·64	5220·24	19·1218	167948	615·195
Butyl fluoride,	$C_4H_9F_5$	75·49	5326·38	19·5106	171363	627·703

Molecular Speeds.

The expression $U=\sqrt{3P/\rho}$ gives us "that speed which all the molecules would have if, without addition or subtraction of energy, the speeds of all were made equal," *i.e.*, U is simply the square root of the mean of the squares of all the individual speeds, or if n be the number of molecules and U_1, U_2, U_3, ... U_n be the individual speeds of each molecule respectively, then

$$U^2=\tfrac{1}{n}(U_1^2+U_2^2+U_3^2+\ \ldots\ U_n^2)$$

The value U thus calculated (generally denoted by G by German writers) is neither the mean velocity nor the most probable velocity of molecular agitation.

O. E. Meyer gives

$$\begin{aligned}\Omega &= \text{The arithmetical mean value of the speeds} = U\sqrt{8/3\pi}.\\ W &= \text{The most probable value of the speed} = U\sqrt{2/3}.\\ \text{and } O &= \text{The mean probable value of the speed} = 1{\cdot}0875\,W.\end{aligned}$$

Now $\Omega=\tfrac{1}{n}(U_1+U_2+U_3+\ \ldots\ U_n)$

and therefore $\Omega^2=\tfrac{1}{n^2}(U_1^2+U_2^2+U_3^2+\ \ldots\ U_n^2+2U_1U_2+2U_1U_3+\ \ldots\ 2U_{n-1}U_n)$

$$\text{so } \Omega^2<\tfrac{1}{n}(U_1^2+U_2^2+U_3^2+\ \ldots\ U_n^2)$$

$$\textit{i.e.},\ \Omega^2<U^2.$$

According to Maxwell's law :—

$$\Omega=4\pi^{-\frac{1}{2}}(km)^{\frac{3}{2}}\int_0^\infty d\omega.\omega^3e^{-km\omega^2}=2(\pi km)^{-\frac{1}{2}}$$

Now the mean kinetic energy of molecular agitation is

$$E=\tfrac{1}{2}mU^2=2\pi^{-\frac{1}{2}}k^{\frac{3}{2}}m^{\frac{5}{2}}\int_0^\infty d\omega.\omega^4e^{-km\omega^2}=\frac{3}{4k}$$

and therefore $\qquad U=\sqrt{3/2km}$

$$\therefore\ \Omega : U=\sqrt{4/\pi km} : \sqrt{3/2km}$$

$$\Omega/U=\sqrt{8/3\pi}=2\sqrt{2/3\pi}=0{\cdot}9213177319.$$

Now the most probable value of the speed is according to Maxwell's law :—

$$\begin{aligned}W=\tfrac{1}{2}\pi^{\frac{1}{2}}\Omega=U\sqrt{2/3}&=U\times0{\cdot}8164965809\\ &=\Omega\times0{\cdot}8862269255.\end{aligned}$$

Putting $\psi=O/W$, Meyer gets—

$$\tfrac{1}{8}\pi^{\frac{1}{2}}=\int_0^\psi d\psi.\psi^2e^{-\psi^2}$$

and from this he calculates—

$$\psi=1{\cdot}0875 \text{ nearly.}$$

Thus we get—

$$\begin{aligned}U=\sqrt{3P/\rho}&=\Omega\times1{\cdot}085402=W\times1{\cdot}224745=O\times1{\cdot}126202\\ \Omega=\ &\quad U\times0{\cdot}921318=W\times1{\cdot}128379=O\times1{\cdot}037590\\ W=\ &\quad U\times0{\cdot}816497=\Omega\times0{\cdot}886227=O\times0{\cdot}919540\\ O=\ &\quad U\times0{\cdot}887940=\Omega\times0{\cdot}963772=W\times1{\cdot}0875.\end{aligned}$$

Meyer, from Jolly's values for ρ for oxygen and nitrogen, calculated that at 0° C. for

Oxygen, $U=461{\cdot}2$ metres per 1″; $\Omega=424{\cdot}9$; $W=376{\cdot}6$ and $O=409{\cdot}5$

Nitrogen, $U=491{\cdot}7$ metres per 1″; $\Omega=453{\cdot}0$; $W=401{\cdot}4$ and $O=436{\cdot}6$.

When B is given in millimetres of ice cold mercury, at sea level in latitude 45°, we get

$$P = \text{Pressure in dynes per cm}^2. = 1333{\cdot}14676139 \times B$$

and when B = 760

$$P = \quad 1013190{\cdot}538656$$

$$U = \sqrt{3P/\rho} = \sqrt{3999{\cdot}44028417 \times B/\rho} = 63{\cdot}241128 \sqrt{B/\rho} \text{ cms. per sec.}$$

when B = 760

$$U = \sqrt{3039571{\cdot}615968/\rho} = 1743{\cdot}436726 \sqrt{1/\rho} \text{ cms. per sec.}$$

For an ideal gas, 1 grm. of which occupies 1 litre under a pressure of 1 atmosphere = 760 mms. of Hg = 1013190·538656 dynes per cm²., we get

U = 55132·310 cms. per sec.
Ω = 50794·375 ,, ,,
O = 48954·184 ,, ,,
W = 46015·342 ,, ,,

For an ideal gas 1 grm. of which occupies 1 litre under a pressure of 1 metre of Hg = 1333146·76139 dynes per cm²., we get

U = 63241·097 cms. per sec.
Ω = 58265·144 ,, ,,
O = 56154·300 ,, ,,
W = 51636·139 ,, ,,

For an ideal gas 1 grm. of which occupies 1 litre under a pressure of 1 megadyne per cm²., we get

U = 54772·256 cms. per sec.
Ω = 50462·651 ,, ,,
O = 48634·477 ,, ,,
W = 44721·360 ,, ,,

For air at 0° C., we get

U = 48481·235 cms. per sec.
Ω = 44666·621 ,, ,,
O = 43048·428 ,, ,,
W = 39584·767 ,, ,,

For hydrogen at 0° C., we get

U = 183913·376 cms. per sec.
Ω = 169442·654 ,, ,,
O = 163304·045 ,, ,,
W = 150164·642 ,, ,,

And for oxygen at 0° C., we get

U = 46120·179 cms. per sec.
Ω = 42491·339 ,, ,,
O = 40951·952 ,, ,,
W = 37656·968 ,, ,,

Assuming that oxygen is 15·884 times as heavy as hydrogen, Meyer gets the following values for the calculated speeds of hydrogen molecules at 0° C.—

$U = 1838{\cdot}2$ metres per second.
$\Omega = 1693{\cdot}6$,, ,, ,,
$O = 1632{\cdot}2$,, ,, ,,
$W = 1500{\cdot}9$,, ,, ,,

TABLE LXXB.—Values of U, Ω, O and W, according to O. E. Meyer.

Substance.		Sp. Gr. referred to Air.	Values in Metres per second for Speeds calculated for 0° C.			
Name.	Formula.		U	Ω	O	W
Hydrogen, ...	H_2	0·06958	1838	1694	1632	1501
Marsh gas, ...	CH_4	555	636	600	565	519
Ammonia, ...	NH_3	5967	624	579	554	509
Water vapour, . .	H_2O	6235	614	566	545	501
Hydrogen cyanide, .	HCN	9476	498	459	442	407
Carbon monoxide, .	CO	9678	493	454	438	402
Nitrogen, . . .	N_2	9726	492	453	437	402
Ethylene, . . .	C_2H_4	9745	491	453	436	401
Air, ...		1·0000	485	447	431	396
Nitric oxide, . .	NO	0388	476	438	423	389
Oxygen, ...	O_2	1052	461	425	409	376
Methyl alcohol, . .	CH_3OH	120	458	422	407	374
Phosphine, . . .	PH_3	15	452	417	401	369
Hydrogen sulphide, .	H_2S	1912	444	409	394	363
Hydrogen chloride, .	HCl	2474	434	400	385	354
Nitrous oxide, . .	N_2O	5204	393	362	349	321
Carbon dioxide, . .	CO_2	5290	392	361	348	320
Alcohol, ...	C_2H_5OH	6133	382	352	339	312
Methyl ether, . .	CH_3OCH_3	617	381	351	338	311
Methyl chloride, . .	CH_3Cl	763	365	337	324	298
Cyanogen, ...	C_2N_2	8064	361	333	321	295
Acetone, ...	CH_3COCH_3	2·0000	343	316	305	280
Ethyl chloride, . .	C_2H_5Cl	219	326	300	289	266
Sulphur dioxide, . .	SO_2	247	324	298	288	264
Chlorine, ...	Cl_2	4502	310	286	275	253
Ether, ...	$C_2H_5OC_2H_5$	586	302	278	268	246
Arsine, ...	AsH_3	695	295	272	262	241
Hydrogen iodide, . .	HI	4·443	230	212	204	188
Bromine, ...	Br_2	5·5243	206	190	183	168
Mercury, ...	Hg	6·976	184	169	163	150
Iodine, ...	I_2	8·716	164	151	146	134

The values of O and W are calculated by the compiler from Meyer's numbers.

By substituting for $1/\rho$ its value, the volume in centimetre cubes occupied by 1 grm. of the gas, we avoid the process of division.

When any number of gases exert the same pressure, P, we have

$$U_a^2 : U_b^2 : U_c^2 : \ldots \ldots = \frac{3P}{\rho_a} : \frac{3P}{\rho_b} : \frac{3P}{\rho_c} : \ldots \ldots = \frac{1}{\rho_a} : \frac{1}{\rho_b} : \frac{1}{\rho_c} : \ldots \ldots$$

That is, when exerting the same pressure the mean square of the molecular speeds is inversely proportional to the density.

$$U_b = U_a \sqrt{\rho_a/\rho_b}$$

or if s = specific gravity of gas ρ_b referred to gas ρ_a as unity

$$U_b = U_a/\sqrt{s}.$$

Putting $\mathfrak{M}$ for the molecular weight of a gas we get ($H_2=2$)

$$\mathfrak{V}/\mathfrak{M} = \text{volume in litres occupied by 1 grm. of the gas,}$$

so at 0° C.

$$U = \sqrt{3039571615 \cdot 968 \times \mathfrak{V}/\mathfrak{M}} = 260092 \cdot 791/\sqrt{\mathfrak{M}}$$

or putting s_a = specific gravity referred to air as unity, we get for 0° C.

$$U = 48481 \cdot 235/\sqrt{s_a}$$

At the same temperature $mU^2/2$ is the same for all gases, so for the same gas—

$$U_1^2 : U_2^2 : U_3^2 : \ldots \ldots = T_1 : T_2 : T_3 : \ldots \ldots$$

so $\quad U_t = U_o \sqrt{1 + at}.$

TABLE LXXc.—**Values of U, Ω, O and W for various Gases and Vapours. Calculated from the Results of Recent Investigations.**

Substance.		Values in Centimetres per 1 sec. of Molecular Speeds at 0° C.				
Name.	$\mathfrak{M}$	U Theoretical.	U Calculated from Density.	Ω	O	W
Hydrogen,	2·00	183913	183912	169444	163302	150165
Methane,	15·91	65207	64924	59817	57649	53011
Ammonia,	16·93	63212	63112	58147	56039	51531
Water vapour,	17·88	61510	61398	56568	54517	50132
Hydrogen fluoride,	19·85	58378	57431	52913	50995	46893
Acetylene,	25·82	51186	50545	46569	44881	41270
Hydrogen cyanide,	26·84	50185	49803	45885	44222	40665
Carbon monoxide,	27·79	49338	49281	45404	43758	40238
Ethylene,	27·82	49312	48844	45001	43370	39881
Nitrogen,	27·86	49276	49164	45296	43655	40143
Air,			48481	44667	43048	39585
Nitric oxide,	29·81	47637	47562	43821	42232	38835
Ethane,	29·82	47629	46759	43081	41519	38179
Oxygen,	31·76	46152	46120	42492	40952	37657
Methyl alcohol,	30·79	46873	45810	42206	40676	37405
Methyl amine,	30·84	46835	46651	42983	41423	38091
Methyl fluoride,	33·76	44764	43893	40441	38974	35839
Hydrogen sulphide,	33·82	44707	44403	40910	39427	36256

TABLE LXXc.—*continued.*

Substance.		Values in Centimetres per 1 sec. of Molecular Speeds at 0° C.				
Name.	𝔐	U Theoretical.	U Calculated from Density.	Ω	O	W
Phosphine,	33·82	44707	44001	40539	39070	35927
Hydrogen chloride,	36·18	43241	43259	39856	38411	35321
Fluorine,	37·70	42362	43190	39793	38350	35265
Allylene,	39·73	41264	41241	37997	36620	33674
Propylene,	41·73	40263	39611	36495	35164	32343
Carbon dioxide,	43·67	39358	39207	36123	34814	32013
Nitrous oxide,	43·74	39327	38161	35159	33885	31159
Ethyl amine,	44·75	38880	38658	35616	34325	31564
Ethyl alcohol,	45·70	38474	38169	35167	33892	31165
Methyl ether,	45·70	38474	38126	35126	33853	31130
Ethyl fluoride,	47·67	37671	37183	34258	33016	30360
Methyl chloride,	50·09	36750	36849	33950	32719	30087
Methylene fluoride,	51·61	36204	36036	33201	31997	29423
Cyanogen,	51·68	36166	36072	33234	32029	29453
Butylene,	55·64	34869	34853	32111	30947	28458
Acetone,	57·61	34267	34281	31584	30439	27991
Butane,	57·64	34258	34196	31506	30364	27921
Carbonyl sulphide,	59·61	33687	33418	30789	29673	27286
Sulphur dioxide,	63·58	32619	32128	29601	28528	26233
Ethyl chloride,	64·00	32512	32546	29985	28898	26574
Nitrosyl chloride,	64·99	32263	31898	29389	28324	26045
Chlorine peroxide,	66·94	31789	31761	29262	28202	25933
Boron fluoride,	67·47	31665	31882	29373	28309	26031
Chlorine,	70·36	31007	30752	28333	27306	25109
Ethyl ether,	73·52	30334	30148	27776	26769	24616
Butyl fluoride,	75·49	29935	30183	27808	26801	24644
Arsine,	77·43	29558	29519	27197	26211	24103
Hydrogen bromide,	80·36	29014	29337	27029	26049	23954
Hydrogen selenide,	80·80	28935	28999	26717	25749	23678
Chlorine monoxide,	86·24	28007	27957	25758	24824	22827
Phosphorus trifluoride,	87·37	27822	27888	25694	24763	22771
Nitric peroxide,	91·38	27208	29725	27387	26394	24271
Carbonyl chloride,	98·15	26253	25896	23858	22994	21144
Phosphorus oxyfluoride,	103·25	25597	25273	23284	22440	20635
Silicon tetrafluoride,	103·58	25556	25552	23542	22688	20863
Phosphorus pentafluoride,	125·07	23257	22880	21080	20316	18681
Hydrogen iodide,	126·90	23089	23026	21215	20446	18801
Hydrogen telluride,	128·04	22986	22882	21082	20318	18683
Phosphorus chlor-fluoride,	157·67	20714	20863	19222	18525	17035
Bromine,	158·72	20645	20286	18690	18013	16564
Mercury,	199·80	18401	18356	16912	16299	14987
Iodine,	251·80	16391	16422	15130	14581	13408

TABLE LXXD.—**Values of Ω_t for Various Vapours.**

Substance. Name.	$\mathfrak{M}$	$t°$	Ω_t	Authority.
Methyl formate,	59·58	32·3	32680	L. Meyer & Schumann
Propyl alcohol,	59·61	97·4	36080	Steudel
Isopropyl ,,	59·61	82·8	35350	,,
Ethyl formate.	73·49	54·3	30490	L. Meyer & Schumann
Methyl acetate,	73·49	57·3	30610	,,
Butyl alcohol,	73·52	116·9	33970	Steudel
,, ,, Iso,	73·52	108·4	32970	,,
,, ,, Tertiary,	73·52	82·9	31840	,,
Carbon disulphide,	75·55	0	29830	Puluj
Benzol,	77·46	0	29540	,,
Propyl chloride,	77·91	46·4	29280	Steudel
Ethyl acetate,	87·40	77·1	28930	L. Meyer & Schumann
Methyl propionate,	87·40	79·6	29040	,,
Propyl formate,	87·40	80·4	29090	,,
Butyl chloride,	91·82	78	28290	Steudel
,, ,, Iso,	91·82	68·5	27900	,,
,, ,, Tertiary,	91·82	52	27210	,,
Ethylene chloride,	98·18	83·5	27570	,,
Ethylidene ,,	98·18	59·9	26630	,,
Isobutyl formate,	101·31	97·9	27610	L. Meyer & Schumann
Ethyl propionate,	101·31	122·2	27680	,,
Methyl butyrate, Iso,	101·31	92·0	27140	,,
Popropyl acetate,	101·31	100·9	27680	,,
Ethyl bromide,	108·18	38·4	24530	Steudel
Amyl formate,	115·22	123·2	26820	L. Meyer & Schumann
Isobutyl acetate,	115·22	116·4	26580	,,
Ethyl butyrate,	115·22	119·8	26700	,,
,, ,, Iso,	115·22	110·2	26370	,,
Methyl valerate,	115·22	116·7	26720	,,
Propyl propionate,	115·22	136·8	26750	,,
Chloroform,	118·45	61·2	24290	Steudel
,,	118·45	0	23810	Puluj
Propyl bromide,	122·09	70·8	24280	Steudel
Isopropyl ,,	122·09	60·0	23890	,,
Isobutyl propionate	129·13	136·8	25770	L. Meyer & Schumann
Ethyl valerate,	129·13	134·4	25690	,,
Propyl butyrate,	129·13	142·7	25960	,,

TABLE LXXd.—*continued.*

Substance. Name.	$\mathfrak{M}$	$t°$	Ω_t	Authority.
Trichlor ethane,	132·36	74°·2	25530	Steudel
Isobutyl bromide,	136·00	92·3	23720	,,
Methyl iodide,	140·81	44·0	21700	,,
Ethylene chlorobromide,	142·36	104·5	23560	,,
Amyl propionate,	143·04	160·2	25180	L. Meyer & Schumann
Isobutyl butyrate,	143·04	156·9	25070	,,
Isobutyl isobutyrate,	143·04	146·5	24770	,,
Carbon tetrachloride,	152·63	76·7	21890	Steudel
Ethyl iodide,	154·72	72·3	21600	,,
Amyl butyrate,	156·95	178·7	24550	L. Meyer & Schumann
,, ,, Iso,	156·95	169·0	24280	,,
Isobutyl valerate,	156·95	168·7	24810	,,
Propyl iodide,	168·63	102 0	21580	Steudel
Butyl iodide,	182·54	130·0	21510	,,
Isobutyl iodide,	182·54	120·0	21240	,,
Ethylene bromide,	186·54	131·6	21320	,,
Bromoform,	250·99	151·2	18820	,,

Distribution of Speeds, etc.

According to Maxwell's law the curve representing the propable distribution of molecular speeds has the equation—

$$y = 4\pi^{-\frac{1}{2}}x^2e^{-x^2}.$$

And the arithmetical mean value –

$$\Omega = 4\pi^{-\frac{1}{2}}(km)^{\frac{3}{2}}\int_0^\infty d\omega \,.\, \omega^3 e^{-km\omega^2} = 2(\pi km)^{-\frac{1}{2}}$$

where $km = \rho/2\mathrm{P}$, so

$$\Omega = \sqrt{\frac{8\mathrm{P}}{\pi\rho}} = \sqrt{\mathrm{P}/\rho} \times 1 \cdot 5957691216\,.$$

Out of every N molecules, if n represent the number which move with a velocity w in a direction making angles ς and ϕ with reference to a fixed axis, and if the gas have a velocity of translation $= o$ then,—

$$n = \mathrm{N}(\pi^{-1}km)^{\frac{3}{2}} e^{-km(\omega^2 - 2\omega o \cos\varsigma + o^2)}\omega^2 d\omega \sin\varsigma d\varsigma d\phi\,.$$

And if $\nu =$ number of all that move with a velocity between w and $w + dw$ we get

$$\nu = \mathrm{N}(\pi^{-1}km)^{\frac{3}{2}}\omega^2 d\omega \int_0^{2\pi} d\phi \int_0^{\pi} d\varsigma \sin\varsigma e^{-km(\omega^2 - 2\omega o\cos\varsigma + o^2)},$$

and if the gas have no motion of translation :—

$$\nu = 4N\pi^{-\frac{1}{2}}(km)^{\frac{3}{2}}\omega^2 e^{-km\omega^2}d\omega \, .$$

This will give a maximum value for ν when $km\omega^2 = 1$, and the value of ω which gives this result will be the most probable velocity, *i.e.*, $\omega = W$.

$$\therefore (\rho/2P)W^2 = 1 \text{ and } W^2 = 2P/\rho$$
$$W = \sqrt{P/\rho} \times 1{\cdot}4142135624$$

And as already stated,—

$$U = \sqrt{P/\rho} \times 1{\cdot}7320508076.$$

O. E. Meyer finds that for oxygen at 0° C.—

$$W = 376{\cdot}6 \text{ metres per second ;}$$

and he calculates that out of every 1000 molecules—

13 to 14	molecules	have a speed	below		100	metres	per second
81 ,, 82	,,	,,	between	100 and	200	,,	,,
166 ,, 167	,,	,,	,,	200 ,,	300	,,	,,
214 ,, 215	,,	,,	,,	300 ,,	400	,,	,,
202 ,, 203	,,	,,	,,	400 ,,	500	,,	,,
151 ,, 152	,,	,,	,,	500 ,,	600	,,	,,
91 ,, 92	,,	,,	,,	600 ,,	700	,,	,,
76 ,, 77	,,	,,	above	700		,,	,,

With the usually accepted atmosphere = 760 mm. of ice-cold mercury = P = 1013190·538656 dynes per cm. square, we get—

$$U = 1743{\cdot}436725/\sqrt{\rho}$$
$$\Omega = 1606{\cdot}259169/\sqrt{\rho}$$
$$O = 1548{\cdot}067261/\sqrt{\rho}$$
$$W = 1423{\cdot}510125/\sqrt{\rho}$$

TABLE LXXE.—Speed of Sound Waves.

Closely connected with the speeds of the molecules is speed of sound waves in a medium. Newton's formula for the speed of sound waves—

$$\omega = \sqrt{ev}$$

where e = elasticity of substance, and v = volume of unit mass, gave results considerably too low. By introducing into this expression Laplace's correction we get the equation—

$$\omega = \sqrt{\kappa ev}$$

which is sufficiently accurate for all practical purposes ; here $\kappa = c_p/c_v$ as before.

For gases we may take $e = P$, and for all substances $v = \dfrac{1}{\rho}$; the Newtonian formula then becomes

$$\omega = \sqrt{P/\rho}$$

and the corrected expression—

$$\omega = \sqrt{\kappa p/\rho} \text{ or } \omega^2 = \kappa p/\rho.$$

We have already seen that—

$$U^2 = 3P/\rho$$

therefore—

$$\omega^2 = U^2 . \frac{\kappa}{3} = \Omega^2 . \frac{\pi\kappa}{8}.$$

Now if λ be the length of a sound wave, and $n =$ the number of vibrations per second, then

$$\omega = n\lambda$$

and as n and λ can be experimentally determined, we have an almost direct method of determining ω, and consequently U and Ω.

For most gases (*i.e.*, all with diatomic molecules) we may put $\kappa = 1{\cdot}405$ and

$$\omega = 1{\cdot}1853\sqrt{P/\rho} = 0{\cdot}68435U = 0{\cdot}7427935\Omega.$$

As to the variation of ω with change of temperature, we get (theoretically)

$\omega_t = \omega_o \sqrt{1 + \alpha t} = \omega_o \sqrt{1 + 0{\cdot}00367t} = \omega_o(1 + 0{\cdot}001835t)$, where t is comparatively small.

For air at 0° C. we got $U = 48481$ cms. per second;

$\therefore \omega = 33178$ cms. ,, ,, $= 1089$ ft. per second.

It will be seen that this agrees very closely with the experimental results given in Table $LXXE_1$.

The expression

$$\omega_t = \omega_o(\sqrt{1 + \alpha t} = \omega_o(1 + \frac{\alpha t}{2} - \frac{1{\cdot}1}{1{\cdot}2}\left(\frac{\alpha t}{2}\right)^2 + \frac{1{\cdot}1{\cdot}3}{1{\cdot}2{\cdot}3} \cdot \left(\frac{\alpha t}{2}\right)^3 - \frac{1{\cdot}1{\cdot}3{\cdot}5}{1{\cdot}2{\cdot}3{\cdot}4} \cdot \left(\frac{\alpha t}{2}\right)^4 + \text{etc.}$$

gives us very nearly 1 ft. as the change in velocity for every degree Fahrenheit change in temperature.

Airy gives ω at 0° F. = 1050 ft. per second, which works out, with the increment of 1 ft. per degree, to 1082 ft. at the melting point of ice. Stone's experiments gave, as a mean value, that ω at 32° F. = 1090·6 ft. per second.

TABLE LXXE$_1$.—Speed of Sound in Gases.

Gas or Vapour.	Values of ω. Calculated metres per second.	Experimentally determined. Metres per second.	Experimentally determined. Feet per second.	* t° C.	Authority, etc.
Air	331·78			0°	
		348·08r.	1142	?	Derham, 1708
		337	1105·6r.	6°	French Academy, 1738
		340·9	1118·4r.	15·9	Bureau des Longitudes, 1822
		332·4	1090·6r.	0	Stampfer & Myrbach, 1823
		332·77	1091·8r.	0	Moll and v. Beek, 1823
		333*	1092·5r.	0	Dulong, 1829
		332·4	1090·6r.	0	Bravais and Martin, 1845
		333*	1092·5r.	0	Masson, 1857
		330·66*	1084·9r.	0	Le Roux, 1863
		331·37	1083·9r.	0	Regnault (short dist.), 1864
		330·71	1085·0r.	0	,, (inter. dist), 1864
		329·9	1082·4r.	0	,, (long dist), 1864
		332·06	1089·4r.	0	Schneebeli, 1869
		332·41r.	1090·6	0	Stone, 1871
		332·5	1090·9r.	0	Kayser, 1877
		331·898*	1088·9r.	0	Wüllner, 1878
		331·676	1088·2r.	0	Blaikley, 1884
		331·2	1086·6r.	0	Violle and Vautier, 1888
		331·4*	1087·3r.	0° to 100°	Gerosa and Mai, 1888
		305·6	1002·6r.	45°·6	Greely, 1888
		309·7	1016·1r.	37·8	,, ,,
		317·1	1040·4r.	−25·7	,, ,,
		326·1	1069·9r.	−10·9	,, ,,
Hydrogen	1258·61			0	
		1269·5*	4165·1r.	0	Dulong, 1829
		1286·362*	4220·4r.	0	Zoch, 1866
Coal gas		490·437*	1609·1r.	0	,, ,,
Methane	431·87			0	
		431·82*	1416·7r.	0	Masson, 1857
Ammonia	418·85			0	
		415·00*	1361·8r.	0	,, ,,
		415·99*	1365·0r.	0	Wüllner, 1878
Water vapour	405·84			0	
		401*	1315·6r.	0	Masson, 1857
		402·4*	1320·2r.	93	Jäger, 1889
		410·0*	1345·2r.	96	,, ,,
Carbon monoxide	337·64			0	
		337·129*	1106·1r.	0	Wüllner, 1878
Ethylene	317·73			0	
		314*	1030·2r.	0	Dulong, 1829
		318·73*	1045·7r.	0	Masson, 1857
		315·902*	1036·4r.	0	Wüllner, 1878
Nitric oxide	326·00			0	
		325*	1066·3r.	0	Masson, 1857
Oxygen	315·84			0	
		317·17*	1040·6r.	0	Dulong, 1829
Hydrogen sulphide	296·55			0	
		289·27*	949·1r.	0	Masson, 1857
Hydrogen chloride	295·92			0	
		297·00*	974·4r.	0	,, ,,
Carbon dioxide	260·20			0	

TABLE $LXXE_1$.—*continued.*

Gas or Vapour.	Values of ω.			$t°$ C.	Authority, etc.
	Calculated metres per second.	Experimentally determined.			
		Metres per second.	Feet per second.		
Carbon dioxide		261·6*	858·3*r*.	0°	Dulong, 1829
		256·83*	842·6*r*.	0	Masson, 1857
		281·91*	924·7*r*.	0	Zoch, 1866
		259·283*	850·7*r*.	0	Wullner, 1878
		263*	862·9*r*.	0	Martini, 1880
Laughing gas	259·94			0	
		259·636*	851·8*r*.	0	Wüllner, 1878
		264*	866·1*r*.	0	Martini, 1880
Alcohol vapour	233·71			0	
		230·59*	756·5*r*.	0	Masson, 1857
		271·0	889·1*r*.	80° to 85°	Neyreneuf, 1886
		235·7*	773·3*r*.	48°	Jäger, 1889
Cyanogen	No data.			0	
		229·48*	752·9*r*.	0	Masson, 1857
Sulphur dioxide	211·56			0	
		209·00*	685·7*r*.	0	,, ,,
Chlorine	212·20			0	
		206·4*	677·2*r*.	0	Martini, 1880
		205·3*	673·6*r*.	0	Strecker, 1881
Ether vapour	180·31			0	
		179·20*	587·9*r*.	0	Masson, 1857
		194·4*	627·8*r*.	35° to 40°	Neyreneuf, 1886
		183·1*	600·7*r*.	20° to 23°	Jäger, 1889
Carbon disulphide vapour	No data.				
		189·00*	620·1*r*.	0	Masson, 1857
Silicon tetrafluoride	No data.			0	
		167·40*	549·2*r*.	0	,, ,,
Bromine vapour	141·28			0	
		135·0*	442·9*r*.	0	Strecker, 1881
Iodine vapour	112·16			0	
		107·7*	353·3*r*.	0	,, ,,

Where *r* is affixed to numbers in cols. 3 and 4, it denotes that they have been calculated from the corresponding numbers in the other column.

In this table κ is taken as 1·405 for gases composed of diatomic molecules; for all others the values are taken from experimental results.

* In all cases where an asterisk is inserted in col. 3, the numbers give the velocity of sound in pipes filled with the gas or vapour: this is never quite the same as in a large mass of the gas. Von Helmholtz gives the formula

$$\omega = \omega_A \left(1 - \frac{C}{D\sqrt{N}}\right)$$

where ω = Velocity of sound in tube filled with gas.

ω_A = Velocity of sound in large, practically unconfined, mass of gas.

D = Diameter of tube.

N = Frequency of the note sounded.

C = A constant which, according to v. Helmholtz, has a value depending only on the friction coefficient of the gas, but according to Kirchhoff it depends on other things as well.

The velocity of sound also depends on the intensity, but the law relating to this has not been satisfactorily indicated.

TABLE LXXE$_2$.—Velocity of Sound in Liquids.

have, for all substances,—

$$\omega^2 = E_\phi/\rho$$

E_ϕ represents the adiabatic elasticity.

ing E_θ for the isothermal elasticity, which can be determined by direct experiments, e,—

$$E_\phi/E_\theta = c_p/c_v = \kappa.$$

for liquids,—

$$c_p - c_v = \alpha^2 \text{VT}E_\theta \qquad \therefore c_v = c_p - \alpha^2 \text{VT}E_\theta$$

α = Co-efficient of cubical expansion,
V = Volume of unit mass,
T = Absolute temperature.

quantities c_p, E_θ, α and V being determined experimentally, we can easily calculate E_ϕ.

water at the point of maximum density (practically = 4° C.) we must have $\alpha = 0$, sequently $c_p = c_v$ and $E_\phi = E_\theta$.

Therefore at 4° C.

$$\omega \text{ in water} = \sqrt{E_\theta/\rho}$$

, in absolute units, $= 2{\cdot}03 \times 10^{10}$ practically, and $\rho = 1$

so ω in cms. per second $= \sqrt{20300000000} = 142478$

velocity at 0° C. would be higher, as α would then be negative.

(1) Water and Simple Liquids.

Description.	Values of ω. Metres per second.	Feet per second.	t° C.	Authority, etc.
, Lake of Geneva,	1435	4708r.	8°·1	Colladon and Sturm, 1827
Seine,	1437·1	4714·9r.	15	Wertheim, 1848
,,	1528·5	5014·8r.	30	,, ,,
,,	1652·2	5420·6r.	50	,, ,,
,,	1724·7	5658·5r.	60	,, ,,
,,	1399	4589·9r.	3·9	Martini, 1888
,,	1437	4714·6r.	13·7	,, ,,
,,	1457	4780·2r.	25·2	,, ,,
ol ethylic (absolute),	1264	4147r.	8·4	,, ,,
	1159·8	3805·2r.	23·0	Wertheim, 1848
	1145	3756·6r.	0	Martini, 1888
	1159	3802·5r.	0	Wertheim, 1848
turpentine,	1371	4498·1r.	3·5	Martini, 1888
	1212·3	3977·4r.	24	Wertheim, 1848
eum,	1395	4576·8r.	7·4	Martini, 1888

TABLE LXX_{E_2}.—*continued.*

(2) Solutions and Mixed Liquids.

Description.	Values of ω. Metres per second.	Feet per second.	t° C.	Authority, etc.
Alcohol (11%) + water	1496	4908·2r.	4°·4	Martini, 1888
Concentrated solution of NaCl	1561·6	5123·4r.	18·1	Wertheim, 1848
,, ,, ,,	1661	5449·5r.	14·7	Martini, 1888
,, ,, $NaNO_3$	1669·9	5478·7r.	20·9	Wertheim, 1848
,, ,, ,,	1650	5413·4r.	15·3	Martini, 1888
,, ,, Na_2CO_3	1594 4	5231 0r.	22·2	Wertheim, 1848
Solution of Na_2SO_4 (11·78%)	1525·1	5002·9r.	20·0	,, ,,
Concentrated solution of Na_2SO_4	1583·5	5195·3r.	18·8	,, ,,
,, ,, ,,	1528	5013·2r.	14·7	Martini, 1888
Concentrated solution of KNO_3	1515	4970·5r.	14·4	,, ,,
Solution of $CaCl_2$ (43·42 %)	1979·6	6494·7r.	22·5	Wertheim, 1848

TABLE LXX_{E_3}.—Velocity of Sound in Solids.

In oords and thin bars we may have lateral shrinkage or expansion accompanying longitudinal disturbances, and in such cases—

$$\omega = \sqrt{\frac{E}{\rho}} \qquad \text{where } E = \text{Modulus of Elasticity (see Table XIX.).}$$

$$E = \frac{9CK}{3K + C} \quad \text{(see Table XIX.).}$$

In solids extended in every direction we may have sound waves, *i.e.*, waves of longitudinal disturbance, propagated with the velocity :—

$$\omega = \sqrt{\frac{3K + 4C}{3\rho}}$$

For rods where the diameter is very great we have from the first equation given in this sub-section—

$$E = \rho\omega^2$$

We can by Kundt's dust method determine ω in rods and bars with a fair degree of accuracy, and ρ being easily ascertained, we can thus make very close approximations to the value of E.

The values in the following table marked with an asterisk are calculated on the supposition that the velocity of sound in air at 0° C. is 332·412 metres per second : the original investigators gave their results in terms of the velocity in air.

TABLE LXXE$_3$.—*continued.*

(1) Metals.

Description.	Value of ω in Metres per second.	Value of ω in Feet per second.	$t°$ C.	Authority, etc.
Aluminium,	5110·8*	16767·9		Masson, 1858
Cadmium,	2309·5*	7577·2		,, ,,
Cobalt,	4730·3*	15519·5		,, ,,
Copper,	3988·9*	13087·1		Chladni, 1802
,,	3829·3*	12563·4		Masson, 1858
,,	3670·4*	12042·1	10°	Wertheim, 1844
,,	3557·8*	11672·7	15° to 20	,, ,,
Gold,	2084·1*	6837·7		Masson, 1858
,, unannealed,	2114·8*	6938·4	10°	Wertheim, 1844
,, annealed,	1743·4*	5719·9	15° to 20°	,, ,,
Iron,	5130·0*	16830·9	15° to 20°	,, ,,
,,	5021·9*	16476·2		Masson, 1858
,, wire,	4918·8*	16137·9	10° to 20°	Wertheim, 1844
,, steel,	5139*	16860·4	0°	(Calculated)
,, ,, soft,	4988*	16365·0	15° to 20°	Wertheim, 1844
,, ,, blue temper,	4886·3*	16031·3	10°	,, ,,
,, ,,	4946·1*	16227·5		Masson, 1858
,, ,,	5099·0*	16729·2		Kundt, 1866
Lead, pure,	1321·6*	4336·0		Masson, 1858
,, soft,	1228·9*	4031·9	15° to 20°	Wertheim, 1844
Magnesium,	4602	15098·6		Melde, 1892
Nickel,	4979·5*	16337·1		Masson, 1858
Palladium,	3077·8*	10097·9	10°	Wertheim, 1844
,,	3260·9*	10698·6		Masson, 1858
Platinum,	2795·6*	9172·0		,, ,,
,, not annealed,	2736·8*	8979·1	10°	Wertheim, 1844
,, annealed,	2688·2*	8819·6	15° to 20°	,, ,,
Silver,	2645·0*	8677·9		Masson, 1858
,, hard,	2677·7*	8785·2	10°	Wertheim, 1844
,, soft,	2608·4*	8557·8	15° to 20°	,, ,,
Tin,	2493·1*	8179·5		Chladni, 1802
,,	2648·7*	8673·6		Masson, 1858
,,	2493·4*	8180·5	13°	Gerosa, 1888
Zinc,	3703·1*	12149·4		Masson, 1858
,,	3685·5*	12091·6	13°	Gerosa, 1888

(2) Alloys.

Brass,	3483·7*	11429·6		Masson, 1858
,, unannealed,	3239·0*	10626·7		Wertheim, 1844
,, rod 5 mm. thick,	3613·8*	11856·4		Kundt, 1866
,, another similar rod	3629·9*	11909·2		,, ,,
Zn_5Sn,	3336·4*	10946·3	13°	Gerosa, 1888
$ZnSn$,	2982·7*	9785·9	13°	,, ,,
$ZnSn_2$,	2711·2*	8895·1	13°	,, ,,

TABLE LXXE$_3$.—*continued.*

(3) Various Solids.

Description.	Value of ω in Metres per second.	Value of ω in Feet per second.	t° C.	Authority, etc.
Glass,	5991	19655·7		Stefan, 1868
,,	5066·0*	16620·9		Kundt, 1866
,,	5202·2*	17067·7	15° to 17°	Warburg, 1869
Burnt clay,	3656·5*	11996·5		Chladni, 1802
Ivory,	3016·4*	9896·4		Ciccone & Campanile, 1891
Wood, beech,	3412	11194·3		Melde, 1892
,, cork (bark),	430 to 530	141·1 to 144·4		,, ,,
,, fir,	5256	17244·3		Stefan, 1868
,, ,,	4179	13710·8		Melde, 1892
,, oak,	3381	11092·6		,, ,,
Shellac,	1320	4330·7		Stefan, 1868
Paraffin,	1305·6*	4283·5	15° to 17°	Warburg, 1869
Stearin,	1379·7*	4526·6	15° to 17°	,, ,,
Suet,	460	1509·2	18°	Stefan, 1868
Tallow,	390·2*	1280·2	15° to 17°	Warburg, 1869
Wax,	863·6*	2833·4	15° to 17°	,, ,,
,,	880	2887·2	17°	Stefan, 1868
,,	630	2066·9	25°	,, ,,
,,	451	1479·7	28°	,, ,,
Caoutchouc string,	46	150·9		,, 1872
,, black vulcanised,	54·0	177·2	0°	Exner, 1874
,, ,,	30·7	100·7	50°	,, ,,
,, red vulcanised,	69·3	227·4	0°	,, ,,
,, ,,	36·6	120·1	57°	,, ,,
,, ,,	33·9	111·2	70°	,, ,,
,, hose,	25 to 30	82 to 98·4		Stefan, 1868
,, grey vulcanised rod,	43·2	141·7	0°	Exner, 1874
,, ,, ,,	32·3	106·0	45°	,, ,,
,, ,, ,, very hard,	150	492·1		Stefan, 1868
Tissue paper stretched with 100 grms.,	1989	6525·7		Melde, 1892
Writing ,, ,, 900 ,,	2107	6912·8		,, ,,
Cotton string ,, 1000 ,,	1260	4133·9		,, ,,
Linen string ,, 1000 ,,	1815	5954·8		,, ,,
Black oilcloth ,, 1000 ,,	559	1834·0		,, ,,
Sheepskin dressed red ,, 100 ,,	471	1545·3		,, ,,

TABLE LXXF_1.—Velocity of Sound in Dry Air, from – 40° C. to + 60° C.

From the Data of Ciccone and Campanile.

$t°$ C.	Values of ω in		$t°$ C.	Values of ω in		$t°$ C.	Values of ω in	
	Metres per second.	Feet per second.		Metres per second.	Feet per second.		Metres per second.	Feet per second.
– 40°	305·37	1001·9	– 22·5°	316·65	1038·9	– 5°	327·55	1074·6
– 39·5	305·70	1003·0	– 22	316·97	1039·9	– 4·5	327·86	1075·7
– 39	306·03	1004·0	– 21·5	317·28	1041·0	– 4	328·16	1076·7
– 38·5	306·36	1005·1	– 21	317·60	1042·0	– 3·5	328·47	1077·7
– 38	306·68	1006·2	– 20·5	317·92	1043·1	– 3	328·77	1078·7
– 37·5	307·01	1007·3	– 20	318·24	1044·1	– 2·5	329·08	1079·7
– 37	307·34	1008·3	– 19·5	318·55	1045·1	– 2	329·38	1080·7
– 36·5	307·67	1009·4	– 19	318·87	1046·2	– 1·5	329·69	1081·7
– 36	307·99	1010·5	– 18·5	319·18	1047·2	– 1	329·99	1082·7
– 35·5	308·32	1011·6	– 18	319·49	1048·2	– 0·5	330·30	1083·7
– 35	308·64	1012·6	– 17·5	319·81	1049·3	0	330·60	1084·7
– 34·5	308·97	1013·7	– 17	320·12	1050·3	+ 0·5	330·90	1085·7
– 34	309·29	1014·7	– 16·5	320·43	1051·3	1	331·21	1086·7
– 33·5	309·61	1015·8	– 16	320·75	1052·3	1·5	331·51	1087·6
– 33	309·93	1016·8	– 15·5	321·06	1053·4	2	331·81	1088·6
– 32·5	310·26	1017·9	– 15	321·37	1054·4	2·5	332·11	1089·6
– 32	310·58	1019·0	– 14·5	321·68	1055·4	3	332·41	1090·6
– 31·5	310·91	1020·1	– 14	321·99	1056·4	3·5	332·72	1091·6
– 31	311·23	1021·1	– 13·5	322·31	1057·5	4	333·02	1092·6
– 30·5	311·55	1022·2	– 13	322·62	1058·5	4·5	333·32	1093·6
– 30	311·86	1023·2	– 12·5	322·93	1059·5	5	333·62	1094·6
– 29·5	312·18	1024·3	– 12	323·24	1060·5	5·5	333·92	1095·5
– 29	312·51	1025·3	– 11·5	323·55	1061·5	6	334·22	1096·5
– 28·5	312·83	1026·4	– 11	323·86	1062·5	6·5	334·52	1097·5
– 28	313·15	1027·4	– 10·5	324·17	1063·6	7	334·82	1098·5
– 27·5	313·47	1028·5	– 10	324·48	1064·6	7·5	335·12	1099·5
– 27	313·79	1029·5	– 9·5	324·79	1065·6	8	335·42	1100·5
– 26·5	314·11	1030·6	– 9	325·09	1066·6	8·5	335·72	1101·5
– 26	314·43	1031·6	– 8·5	325·40	1067·6	9	336·02	1102·4
– 25·5	314·75	1032·7	– 8	325·71	1068·6	9·5	336·31	1103·4
– 25	315·07	1033·7	– 7·5	326·02	1069·6	10	336·61	1104·4
– 24·5	315·39	1034·8	– 7	326·33	1070·6	10·5	336·91	1105·4
– 24	315·70	1035·8	– 6·5	326·63	1071·6	11	337·21	1106·3
– 23·5	316·02	1036·8	– 6	326·94	1072·6	11·5	337·50	1107·3
– 23	316·34	1037·9	– 5·5	327·25	1073·6	12	337·80	1108·3

TABLE LXX$_{F_1}$.—*continued.*

$t°$ C.	Values of ω in		$t°$ C.	Values of ω in		$t°$ C.	Values of ω in	
	Metres per second.	Feet per second.		Metres per second.	Feet per second.		Metres per second.	Feet per second.
12°·5	338·10	1109·3	28°·5	347·46	1140·0	44°·5	356·58	1169·9
13	338·39	1110·2	29	347·75	1140·9	45	356·86	1170·8
13·5	338·69	1111·2	29·5	348·04	1141·9	45·5	357·14	1171·7
14	338·99	1112·2	30	348·32	1142·8	46	357·42	1172·6
14·5	339·28	1113·1	30·5	348·61	1143·7	46·5	357·70	1173·6
15	339·58	1114·1	31	348·90	1144·7	47	357·98	1174·5
15·5	339·87	1115·1	31·5	349·19	1145·6	47·5	358·26	1175·4
16	340·17	1116·1	32	349·47	1146·6	48	358·54	1176·3
16·5	340·46	1117·0	32·5	349·76	1147·5	48·5	358·82	1177·2
17	340·76	1118·0	33	350·05	1148·5	49	359·10	1178·2
17·5	341·05	1118·9	33·5	350·33	1149·4	49·5	358·38	1179·1
18	341·35	1119·9	34	350·62	1150·3	50	359·66	1180·0
18·5	341·64	1120·9	34·5	350·91	1151·3	50·5	360·93	1180·9
19	341·93	1121·8	35	351·19	1152·2	51	360·21	1181·8
19·5	342·22	1122·8	35·5	351·48	1153·2	51·5	360·49	1182·7
20	342·52	1123·8	36	351·76	1154·1	52	360·77	1183·6
20·5	342·81	1124·7	36·5	352·05	1155·0	52·5	361·04	1184·5
21	343·10	1125·7	37	352·33	1155·9	53	361·32	1185·4
21·5	343·39	1126·6	37·5	352·62	1156·9	53·5	361·60	1186·4
22	343·69	1127·6	38	352·90	1157·8	54	361·88	1187·3
22·5	343·98	1128·6	38·5	353·18	1158·7	54·5	362·15	1188·2
23	344·27	1129·5	39	353·47	1159·7	55	362·43	1189·1
23·5	344·56	1130·5	39·5	353·66	1160·6	55·5	362·71	1190·0
24	344·85	1131·4	40	354·04	1161·6	56	362·99	1190·9
24·5	345·14	1132·4	40·5	354·32	1162·5	56·5	363·26	1191·8
25	345·43	1133·3	41	354·60	1163·4	57	363·54	1192·7
25·5	345·72	1134·3	41·5	354·89	1164·3	57·5	363·81	1193·6
26	346·01	1135·2	42	355·17	1165·3	58	364·09	1194·5
26·5	346·30	1136·2	42·5	355·45	1166·2	58·5	364·36	1195·4
27	346·59	1137·1	43	355·73	1167·1	59	364·64	1196·3
27·5	346·88	1138·1	43·5	356·01	1168·0	59·5	364·91	1197·2
28	347·17	1139·0	44	356·29	1168·9	60	365·19	1198·1

TABLE LXXF_2.—Velocity of Sound in Dry Air from − 40° F. to + 140° F.

(From the Data of Ciccone and Campanile.)

t° F.	Values of ω in		t° F.	Values of ω in		t° F.	Values of ω in	
	Metres per second.	Feet per second.		Metres per second.	Feet per second.		Metres per second.	Feet per second.
− 40°	305·37	1001·9	− 5°	317·89	1043·0	30°	329·92	1082·4
− 39	305·74	1003·1	− 4	318·24	1044·1	31	330·26	1083·5
− 38	306·10	1004·3	− 3	318·59	1045·3	32	330·60	1084·7
− 37	306·47	1005·5	− 2	318·94	1046·4	33	330·94	1085·8
− 36	306·83	1006·7	− 1	319·28	1047·5	34	331·27	1086·9
− 35	307·19	1007·9	0	319·63	1048·7	35	331·61	1088·0
− 34	307·56	1009·1	1	319·98	1049·8	36	331·94	1089·1
− 33	307·92	1010·3	2	320·33	1051·0	37	332·28	1090·2
− 32	308·28	1011·4	3	320·68	1052·1	38	332·61	1091·3
− 31	308·64	1012·6	4	321·02	1053·2	39	332·95	1092·4
− 30	309·00	1013·8	5	321·37	1054·4	40	333·28	1093·5
− 29	309·36	1015·0	6	321·72	1055·5	41	333·62	1094·6
− 28	309·71	1016·1	7	322·06	1056·6	42	333·95	1095·7
− 27	310·07	1017·3	8	322·41	1057·8	43	334·28	1096·8
− 26	310·43	1018·5	9	322·75	1858·9	44	334·62	1097·9
− 25	310·79	1019·7	10	323·10	1060·0	45	334·95	1099·0
− 24	311·14	1020·8	11	323·44	1061·2	46	335·28	1100·0
− 23	311·50	1022·0	12	323·79	1062·3	47	335·61	1101·1
− 22	311·86	1023·2	13	324·13	1063·4	48	335·95	1102·2
− 21	312·22	1024·4	14	324·48	1064·6	49	336·28	1103·3
− 20	312·57	1025·5	15	324·82	1065·7	50	336·61	1104·4
− 19	312·93	1026·7	16	325·16	1066·8	51	336·94	1105·5
− 18	313·29	1027·9	17	325·50	1067·9	52	337·27	1106·5
− 17	313·64	1029·0	18	325·84	1069·0	53	337·60	1107·6
− 16	314·00	1030·2	19	326·19	1070·2	54	337·93	1108·7
− 15	314·36	1031·4	20	326·53	1071·3	55	338·26	1109·8
− 14	314·71	1032·5	21	326·87	1072·4	56	338·59	1110·9
− 13	315·07	1033·7	22	327·21	1073·5	57	338·92	1112·0
− 12	315·42	1034·9	23	327·55	1074·6	58	339·25	1113·0
− 11	315·77	1036·0	24	327·89	1075·8	59	339·58	1114·1
− 10	316·13	1037·2	25	328·23	1076·9	60	339·91	1115·2
− 9	316·48	1038·3	26	328·57	1078·0	61	340·23	1116·3
− 8	316·83	1039·5	27	328·91	1079·1	62	340·56	1117·3
− 7	317·18	1040·6	28	329·24	1080·2	63	240·89	1118·4
− 6	317·54	1041·8	29	329·58	1081·3	64	341·21	1119·5

TABLE LXX$_{F_2}$.—*continued.*

t° F.	Values of ω in Metres per second.	Values of ω in Feet per second.	t° F.	Values of ω in Metres per second.	Values of ω in Feet per second.	t° F.	Values of ω in Metres per second.	Values of ω in Feet per second.
65°	341·54	1120·5	91°	349·91	1148·0	116°	357·79	1173·9
66	341·87	1121·6	92	350·23	1149·1	117	358·10	1174·9
67	342·19	1122·7	93	350·55	1150·1	118	358·42	1175·9
68	342·52	1123·8	94	350·87	1151·2	119	358·73	1176·9
69	342·84	1124·8	95	351·19	1152·2	120	359·04	1178·0
70	343·17	1125·9	96	351·51	1153·3	121	359·35	1179·0
71	343·49	1126·9	97	351·82	1154·3	122	359·66	1180·0
72	343·81	1128·0	98	352·14	1155·3	123	359·97	1181·0
73	344·14	1129·1	99	352·46	1156·4	124	360·28	1182·0
74	344·46	1130·1	100	352·77	1157·4	125	360·58	1183·0
75	344·78	1131·2	101	353·09	1158·4	126	360·89	1184·0
76	345·11	1132·3	102	353·41	1159·5	127	361·20	1185·0
77	345·43	1133·3	103	353·72	1160·5	128	361·51	1186·1
78	345·75	1134·4	104	354·04	1161·6	129	361·81	1187·1
79	346·07	1135·4	105	354·35	1162·6	130	362·12	1188·1
80	346·39	1136·5	106	354·67	1163·6	131	362·43	1189·1
81	346·71	1137·5	107	354·98	1164·6	132	362·74	1190·1
82	347·04	1138·6	108	355·29	1165·7	133	363·04	1191·1
83	347·36	1139·6	109	355·61	1166·7	134	363·35	1192·1
84	347·68	1140·7	110	355·92	1167·7	135	363·66	1193·1
85	348·00	1141·7	111	356·23	1168·7	136	363·96	1194·1
86	348·32	1142·8	112	356·55	1169·8	137	364·27	1195·1
87	348·64	1143·8	113	356·86	1170·8	138	364·58	1196·1
88	348·96	1144·9	114	357·17	1171·8	139	364·88	1197·1
89	349·28	1145·9	115	357·48	1172·8	140	365·19	1198·1
90	349·60	1147·0						

TABLE LXXa.—**Viscosity or Internal Friction of Gases and Vapours.**

(1) Values of η (Coefficient of Viscosity in absolute units) for substances boiling below 0° C.

Description.	t° C.	η_t	Authority, etc.
Air,	12°	0·00275	Calculated by O. E. Meyer from Bessel's (1828) result with pendulum.
	0	0·0001683	Graham, (transpiration) 1846
	20	1900	,, ,,
		177	,, calculated by O. E. Meyer (1866)
		3842	Girault, (pendulum), 1860, calculated by O. E. Meyer.
	18	216	Girault, (pendulum), 1860, calculated by O. E. Meyer.
	8·3	333	O. E. Meyer, oscillating discs, 1863
	21·5	323	,, ,, ,,
	34·4	366	,, ,, ,,
	17·6	185	O. E. Meyer, under diminished pressures, ,,
	19·6	218	,, ,, ,, ,,
	20·1	162	,, ,, ,, ,,
	21·6	122	,, ,, ,, ,,
	0	1878	Maxwell, oscillating discs, (improved) 1866
	20	1980	,, ,, ,, ,,
	18	200	O. E. Meyer, oscillating discs, (improved) 1871
	19	196	,, ,, ,, ,,
	20	1880	O. E. Meyer and Springmühl 1873
	0	172	,, ,, ,,
	0	1789	Puluj, oscillating discs, (improved) 1874
	0	1800	,, ,, ,, ,,
	0	1708	v. Obermayer, (transpiration), 1875
	15	179	Kundt and Warburg, (oscillations), ,,
	25·7	1890	,, , (oscillations), 1876
	100	2250	,, ,, ,,
	20	1917	Puluj ,, ,,
	0	1822	,, ,, ,,
	0	16775	v. Obermayer, (transpiration), ,,
	0	17696	E. Wiedemann ,,
	0	167	v. Obermayer, (transpiration), ,,
	0	168	,, ,, ,,
	0	171	O. E. Meyer, (capillary passage), 1877
	0	170	,, ,, ,,
	0	174	,, ,, ,,
	0	1750	Puluj, (oscillations), 1878
	16·7	1830	,, ,, ,,
	0	1679	Schumann, oscillating discs, (improved) 1884
	0	171	Schneebeli, (transpiration), 1885
	0	17155	Tomlinson, (oscillation, with cylinders), 1886

TABLE LXXG. (1)—*continued.*

Description.	$t°$ C.	η_t	Authority, etc.
Ammonia, . . .	0°	0·0000957	Graham 1846
	0	0980	„ calculated by O. E. Meyer.
	20	1080	„ „ „
Argon, ...	0	208	Lord Rayleigh, (transpiration), calculated by O. E. Meyer.
Carbon dioxide, . .	0	1414	Graham.
	0	145	„ calculated by O. E. Meyer.
	20	1600	„
	20	1614	Maxwell.
	20	1568	v. Lang 1871
	20	1600	O. E. Meyer and Springmühl.
	15	1520	Kundt and Warburg.
	0	1432	Puluj 1876
	19·9	1528	„ „
	0	13821	v. Obermayer.
	0	14972	Schumann.
	12·8	1422	„
	100	1972	„
„ monoxide, . .	0	163	Graham.
	0	167	„ calculated by O. E. Meyer.
	20	184	„
	0	16252	v. Obermayer.
Chlorine, . . .	0	1287	Graham.
	20	1470	„
Cyanogen, . . .	0	0948	„
	20	1070	„
Ethylene, . . .	0	0966	„
	0	099	„ calculated by O. E. Meyer.
	20	109	„ „ „
	0	09222	v. Obermayer.
Helium, . . .	0	165	Lord Rayleigh (1896), transpiration, calculated by O. E. Meyer.
Hydrogen, . . .	0	0822	Graham.
	0	084	„ calculated by O. E. Meyer.
	20	093	„
	20	097	Maxwell.
	20	113	O. E. Meyer and Springmühl.
	15	0923	Kundt and Warburg.
	0	086055	v. Obermayer.
	0	0875	Warburg.
	0	0893	Puluj 1876
	15·85	09285	„ „
	0	0870	„ 1878

TABLE LXXa. (1)—*continued.*

Description.	$t°$ C.	η_t	Authority, etc.	
en, . . .	21·1	0·0000915	Puluj	1878
	0	087	O. E. Meyer.	
chloride, .	0	1379	Graham.	
	0	141	„ calculated by O. E. Meyer.	
	20	156	„ „ „	
sulphide, .	0	1154	„	
	0	118	„ calculated by O. E. Meyer.	
	20	130	„ „ „	
e, . . .	0	104	„	
	0	106	„ calculated by O. E. Meyer.	
	20	120	„ „ „	
chloride, . .	0	1025	„	
	0	105	„ calculated by O. E. Meyer.	
	20	116	„ „ „	
ether, . .	0	0905	„	
	0	092	„ calculated by O. E. Meyer.	
	20	102	„ „ „	
n, . . .	0	1635	„	
	0	167	„ calculated by O. E. Meyer.	
	20	184	„ „ „	
	0	166	v. Obermayer.	
	0	16856	„	
xide, . .	0	1645	Graham.	
	0	1680	„ calculated by O. E. Meyer.	
	20	1860	„ „ „	
oxide, . .	0	1048	„	
	0	144	„ calculated by O. E. Meyer.	
	20	160	„ „ „	
	0	13533	v. Obermayer.	
, . . .	0	191	Graham, calculated by O. E. Meyer.	
	20	212	„ „ „	
	0	197	„ „ „	
	0	199	„ „ „	
	0	1873	v. Obermayer.	
	20	206	„	
r dioxide, . .	0	1225	Graham.	
	0	125	„ calculated by O. E. Meyer.	
	20	138	„ „ „	

TABLE LXXG.—*continued.*

(2) Values of η for the Vapours that liquefy, under ordinary Atmospheric Pressure, above 0° C.

Description.	t° C.	η_t	Authority, etc.	
Acetic acid,	119°·1	0·0001060	L. Meyer and Schumann	1881
Acetone,	0	0725	Puluj	1878
	18	0780	,,	
Alcohol,	0	0827	,,	
	16·8	0885	,,	
	78·4	1420	Steudel	1882
Amyl butyrate,	178·7	1550	L. Meyer and Schumann	1881
,, iso-butyrate,	169·0	1550	,, ,,	,,
,, formate,	123·2	1600	,, ,,	,,
,, propionate,	160·2	158	,, ,,	
Benzol,	0	0709	Puluj.	
	0	0689	,,	
	71·7	138	L. Meyer.	
	72·1	141	,,	
	75·9	144	,,	
	81·0	151	,,	
	88·7	156	,,	
	19·0	07915	Schumann.	
	70·1	1007	,,	
	100	1176	,,	
	19·0	07723	,, as given by O. E. Meyer.	
	70·1	09842	,, ,, ,,	
	100	1148	,, ,, ,,	
Bromoform,	151·2	253	Steudel.	
i-Butyl acetate,	116·4	155	L. Meyer and Schumann.	
	0	0701	Schumann.	
	16·1	0764	,,	
	100	112	,,	
Butyl alcohol, normal,	116·9	143	Steudel.	
,, iso,	108·4	1445	,,	
,, tertiary,	82·9	1600	,,	
i-Butyl bromide,	92·3	1795	,,	
,, butyrate,	156·9	167	L. Meyer and Schumann.	
,, *i*-butyrate,	146·5	158	,, ,,	
Butyl chloride, normal,	78	1495	Steudel.	
,, iso,	68·5	1500	,,	
,, tertiary,	52	1495	,,	
i-Butyl formate,	97·9	172	L. Meyer and Schumann.	
	0	07139	Schumann.	
	17·7	08301	,,	
	63·6	09721	,,	

TABLE LXXa. (2)—*continued.*

Description.	t° C.	η_t	Authority, etc.
i-Butyl formate,	99·9	0·0001142	Schumann.
Butyl iodide, normal,	130	2020	Steudel.
„ iso,	89·3	2015	„
i-Butyl propionate,	136·8	164	L. Meyer and Schumann.
„ valerate,	168·7	154	„ „
Butyric acid, normal,	161·7	130	„ „
„ iso,	152·0	122	„ „
Carbon disulphide,	0	0924	Puluj.
	16·9	0990	„
„ tetrachloride,	76·7	195	Steudel.
Chlor-ethyl chloride,	113·6	181	„
Chloroform,	0	0959	Puluj.
	17·4	1029	„
	61·2	189	Steudel.
Ethane, trichlor.	74·2	190	„
Ether (ethylic),	0	0689	Puluj.
	7·2	0712	„
	10	0716	„
	16·1	0732	„
	18·9	0735	„
	31·9	0771	„
	36·5	0793	„
Ethyl acetate,	77·1	1520	L. Meyer and Schumann.
„ bromide,	38·1	1865	Steudel.
„ butyrate,	119·8	160	L. Meyer and Schumann.
„ *i*-butyrate,	110·2	151	„ „
„ chloride,	0	0935	Graham.
	0	095	„ calculated by O. E. Meyer.
	20	1050	„ „ „
	0	088903	v. Obermayer.
„ formate,	54·3	156	L. Meyer and Schumann.
„ iodide,	72·3	216	Steudel.
„ propionate,	122·2	153	L. Meyer and Schumann.
	0	07079	Schumann.
	16·1	07499	„
	68·6	1054	„
	99·9	1161	„
„ valerate,	134·4	165	L. Meyer and Schumann.
Ethylene bromide,	131·6	221	Steudel.
„ chloride,	83·5	168	„
„ chloro-bromide,	104·5	200	„
Ethylidene chloride,	59·9	1665	„
Formic acid,	99·9	113	L. Meyer and Schumann.
Mercury,	0	162	S. Koch 1883
	300	532	„
	380	656	„

TABLE LXXG. (2)—*continued.*

Description.	$t°$ C.	η_t	Authority, etc.
Methyl acetate, . .	57°·3	0·000152	L. Meyer and Schumann.
,, alcohol, . .	66·8	135	Steudel.
,, butyrate, normal,	102·4	159	L. Meyer and Schumann.
,, ,, iso, .	92	152	Schumann.
	0	07011	,,
	24	07536	,,
	65·5	09986	,,
	100	1122	,,
,, formate, . .	32·3	173	L. Meyer and Schumann.
	0	08378	Schumann.
	20	09228	,,
	100	1352	,,
,, iodide, . .	44	2325	Steudel.
,, propionate, .	79·6	150	L. Meyer and Schumann.
,, valerate, . .	116·7	163	,, ,,
Propionic acid, . .	139·8	118	,, ,,
Propyl acetate, . .	100·9	160	,, ,,
	0	06855	Schumann.
	15	07429	,,
	77·8	09539	,,
	100	1096	,,
,, alcohol, normal, .	97·4	142	Steudel.
,, ,, iso, .	82·8	162	,,
,, bromide, normal,	70·8	1845	,,
,, ,, iso, .	60	176	,,
,, butyrate, . .	142·7	164	L. Meyer and Schumann.
,, *i*-butyrate, . .	133·9	153	,, ,,
,, chloride, normal,	46·4	1455	Steudel.
,, ,, iso, .	37	1485	,,
,, formate, . .	80·4	159	L. Meyer and Schumann.
,, iodide, normal, .	102	210	Steudel.
,, ,, iso, . .	89·3	2015	,,
,, propionate, .	136·8	164	L. Meyer and Schumann.
,, valerate, . .	155·9	167	,, ,,
Valeric acid, . .	174·5	136	,, ,,
Water vapour, . .	20	0975	Kundt and Warburg.
	0	0904	Puluj.
	16·7	0967	,,
	100	132	L. Meyer and Schumann.
Alcohols, $C_nH_{2n+1}OH$, .	At their	142	L. Meyer, etc.
Chlorides, $C_nH_{2n+1}Cl$, .	several	150	,,
Bromides, $C_nH_{2n+1}Br$, .	boiling	182	,,
Iodides, $C_nH_{2n+1}I$, .	points	210	,,
Esters, $C_nH_{2n}O_2$, . .	under 1 atmo.	155	,,

TABLE LXXa.—*continued.*

(3) Variation of η with Temperature.

We have, as we shall see a little further on,

$$\eta = \kappa\rho\Omega L,$$

where κ is a constant, the value of which has been calculated by the late Wilhelm Coman as = 0·30967, and L is the length of the mean free path of the molecules of a gas. In gases L varies as the absolute temperature very nearly, and $\Omega \propto \sqrt{T}$. From this we get Sutherland's deduction that

$$\eta \propto T^{\frac{3}{2}}$$

or $$\eta_t = \eta_0(1+at)^{\frac{3}{2}}$$

O. E. Meyer puts this in the form—

$$\eta_T = HT^{\frac{3}{2}}$$

where $H = \eta_0/T_0^{\frac{3}{2}}$

By the aid of this formula Meyer calculated the following values for H from Schumann's determinations of the value of η at the various temperatures:—

	$t°$	H
Benzol,	19·0	0·0,1552
	70·1	1552
	100	1597
Methyl formate,	20	1845
	100	1841
Methyl *i*-butyrate,	21	1476
	65·5	1656
	100	1561
Ethyl propionate,	16·1	1530
	68·6	1673
	99·9	1616
Propyl acetate,	15	1524
	77·8	1455
	100	1521
Iso-butyl formate,	17·7	1679
	63·6	1578
	99·9	1589
Iso-butyl acetate,	16·1	1558
	100	1558

The values of H should be identical for the same gas or vapour at all temperatures; the above agree quite as closely as any experimental determinations of η are likely to do.

Schumann gives—

$$\eta_t = \eta_0\sqrt{1+at}(1+\gamma t)^2$$

For Air	$a = 0·003665$	and	$\gamma = 0·000802$
„ CO_2	$a = 0·003701$	„	$\gamma = 0·000899$
„ Esters	$a = 0·004$	„	$\gamma = 0·00164$
„ Benzol	$a = 0·004$	„	$\gamma = 0·00185$

Puluj between 3° and 30° C found—

for Air $\eta_t = \eta_0(1+0·00265t) = \eta_0 T^{0·72}$

„ CO_2 $\eta_t = \eta_0(1+0·003378t) = \eta_0 T^{0·92}$

„ H_2 $\eta_t = \eta_0(1+0·002535t) = \eta_0 T^{0·69}$

S. Koch found for Hg vapour—

$$\eta_t = \eta_0(1+at)^{1·60}$$

By means of these and similar formulæ values of η can be calculated for various temperatures with a very close approximation to the true values.

TABLE LXXG (3).—Variation in the Value of η with Change of Temperature.

Values of η_0 and of the constants in the formulæ :—

(i.) $\eta_t = \eta_0(1+\beta t)$	(O. E. Meyer and v. Obermayer.)	(iv.) $\eta_t = \eta_0(1+\alpha t)^n$	O. E. Meyer and v. Obermayer.
(ii.) $\eta_t = \eta_0(1+\alpha t)^{\frac{3}{2}}$	(Sutherland.)	(v.) $\eta_T = HT^{\frac{3}{2}}$	O. E. Meyer.
(iii.) $\eta_t = \eta_0\sqrt{1+\alpha t}(1+\gamma t)^2$	(Schumann.)	(vi.) $\eta_T = \eta_0 T^q$	Puluj.

Gas or Vapour.	η_0	α	β	γ	H	n	q	Range.	From the Data of
	0·000	0·00	0·00	0·00	$0·0_7$				
Air, ...	1720	3665	273		3185		0·04155	20° to 100°	O. E. Meyer
	1789		240		3672			13·4 – 27·2	Puluj
	1708		255		3142		03836	– 21·5 – 99·5	v. Obermayer
	1800		220					1·1 – 77·4	Puluj
	1822	3695				0·72196		– 3·14 – 25·57	,,
	16775	3665	274			7601		– 21·5 – 53·5	v. Obermayer
						733	03869	0 –100	E. Wiedemann
	17696					670		100 –184·5	,,
		3665				78		24·5 –100·2	Warburg
		3665				77		0 –100	Holman
	1679	3665		0802			04064	0 –100	Schumann
Carbon dioxide, . .	1432	3706				91654		1·33 – 29·07	Puluj
	13821	3701	348			941		– 21·5 – 53·5	v. Obermayer
						930		0 –100	E. Wiedemann
						802		100 –184·5	,,
	14972	3701		0889				12·8 –100	Schumann
Carbon monoxide, .	16252	3665	269			738		17·5 –53·5	v. Obermayer
						695		0 –184·5	E. Wiedemann
Ethylene, . . .	09222	3665	350			958		– 21·5 – 53·5	v. Obermayer
						965	05066	0 –100	E. Wiedemann

TABLE LXXG. (3)—*continued.*

Gas or Vapour.	η_0	α	β	γ	H	n	q	Range.	From the Data of
	0·000	0·00	0·00	0·00	$0·0_7$				
Ethylene, . . .						0·823		100° to 184°·5	E. Wiedemann
Hydrogen, . . .	0893	3665				69312		—1·5 – 30·18	Puluj
	086055	3665	249			699		14 – 53·5	v. Obermayer
	0875	3665				63		20 – 99·5	Warburg
Nitrogen, . . .	16586	3665	264			744		—21·5 – 53·5	v. Obermayer
Nitrous oxide, . .	13533	3719	345			929		—21·5 –100·3	"
						960	0·0504	0 –100	E. Wiedemann
						787		100 –184·5	"
Oxygen, . . .	1873	3665	283			787		15·4 –53·5	v. Obermayer
Benzol, . . .	06894	4		185	1567			18·7 –100	Schumann
i-Butyl acetate, . .	0701	4		160	1558			16·1 –100	"
i-Butyl formate, .	07139	4		109	1615			17·7 –100	"
Ether, ...	0689	41575				94		0 – 36·5	Puluj
Ethyl chloride, . .	088903	3900	381					16·1 – 68·6	Schumann
Ethyl propionate, . .	07079	4		225	1606			18·7 –100	"
Mercury, . . .	1620	3665				1·6		273 –380	S. Koch
Methyl formate, . .	0838	4		174	1843			19 –100	Schumann
Methyl *i*-butyrate. .	07011	4		167	1564			24 –100	"
Propyl acetate, . .	06855	4		151	1524			15 –100	"

TABLE LXXH.—Viscosity of Liquids.

(1) Values of η for Simple Liquids.

An asterisk denotes that the value to which it is affixed has been calculated from the specific viscosity.

Liquid.	$t°$ C.	η	Authority.
Acetoacetic ether,	20°	0·01716	Gartenmeister
Acetaldehyde,	10° to 20	003735	Rellstab*
	10°	002887	Pribram and Handl*
Acetic acid,	11·2	02879	Poiseuille
	10	015231	Rellstab*
	30	011080	,,
	50	008842	,,
	10	015158	Pribram and Handl*
	30	011008	,,
	50	008301	,,
	20	01256	Gartenmeister
Acetone,	20	00406	Graham
	10	003970	Rellstab*
	15	003880	,,
	20	003808	,,
	25	003735	,,
	30	003663	,,
	40	003501	,,
	50	003356	,,
	10	004331	Pribram and Handl*
	15	004150	,,
	20	003970	,,
	25	003790	,,
	30	003609	,,
	40	003248	,,
	50	002887	,,
	20	00334	Gartenmeister
Allyl acetate,	10	006911	Pribram and Handl*
	15	006496	,,
	20	006136	,,
	25	005775	,,
	30	005504	,,
	40	004962	,,
	50	004511	,,
Allyl alcohol,	10	020933	,,
	15	018767	,,
	20	016602	,,
	25	014436	,,
	30	012993	,,
	40	010466	,,
	50	008481	,,
Allyl bromide,	10	006136	,,
	15	005684	,,
	20	005414	,,

TABLE LXXII. (1) *continued.*

d.	$t°$ C.	η	Authority.
. . .	25°	0·005143	Pribram and Handl*
	30	004872	,,
	40	004121	,,
	50	004150	,,
. . .	10	003970	,,
	15	003790	,,
	20	003609	,,
	25	003429	,,
	30	003348	,,
. . .	10	008121	,,
	15	007669	,,
	20	007308	,,
	25	006948	,,
	30	006587	,,
	40	005955	,,
	50	005411	,,
. . .	11·9	01598	Poiseuille
	11·5	01486	,,
. . .	10	010719	Pribram and Handl*
	15	009891	,,
	20	009023	,,
	25	008355	,,
	30	007760	,,
	40	006569	,,
	50	005901	,,
. . .	10	016133	Rellstab*
	15	014779	,,
	20	013126	,,
	25	012397	,,
	30	011369	,,
	40	009546	,,
	50	007958	,,
rmentation), .	20	03696	Graham
	10	066047	Pribram and Handl*
	15	055761	,,
	20	047640	,,
	25	040603	,,
	30	034828	,,
	40	025805	,,
	50	019850	,,
. . .	15	048490	Rellstab*
	20	043995	,,
	25	038906	,,
	30	033962	,,
	40	024127	,,
	50	018677	,,
	0	08922	Pagliani and Battelli

TABLE LXXH. (1)—*continued.*

Liquid.	$t°$ C.	η	Authority.
Amyl (i) alcohol, . . .	10°	0·06234	Pagliani and Battelli
	20	04579	Traube
	30	03400	,,
	40	02537	,,
	50	01940	,,
	60	01612	,,
Amyl (i) aldehyde, . .	10	007164	Rellstab*
	30	005847	,,
	50	004529	,,
	10	007128	Pribram and Handl*
	30	005504	,,
	50	004421	,,
Amyl (n) benzoate, . .	10	048073	de Heen*
	30	027646	,,
	50	017901	,,
Amyl (i) bromide, . . .	10	014436	Pribram and Handl*
	15	012993	,,
	20	011730	,,
	25	010827	,,
	30	010015	,,
	40	006587	,,
	50	007272	,,
Amyl butyrate, . . .	10	013336	de Heen*
	30	009781	,,
	50	007763	,,
Amyl (i) chloride, . .	10	006316	Pribram and Handl*
	15	005865	,,
	20	005414	,,
	25	005233	,,
	30	004963	,,
	40	004511	,,
	50	003970	,,
Amyl (i) formate, . . .	10	009275	Rellstab*
	15	008806	,,
	20	008319	,,
	25	007832	,,
	30	007345	,,
	40	006388	,,
	50	005612	,,
Amyl (i) iodide, . . .	10	012091	Pribram and Handl*
	15	011188	,,
	20	010466	,,
	25	009925	,,
	30	009203	,,
	40	008121	,,
	50	007218	,,
Amyl valerate, . . .	10	016746	de Heen*

BLE LXXII. (1) *continued.*

	$t°$ C.	η	Authority.
Butyl	30°	0·011585	de Heen*
	50	008878	,,
Buty	10	016981	Rollstab*
	15	015357	,,
	20	014058	,,
	25	012867	,,
	30	011802	,,
	40	010087	,,
	50	008734	,,
	12	06023	Poiseuille
	20	04467	,,
	30	03238	,,
	40	02450	,,
	50	01925	,,
	60	01555	,,
	20	01110	Gartenmeister
	10	017342	Rollstab*
Butyl	15	016259	,,
	20	015158	,,
	25	014076	,,
	30	012975	,,
	40	011351	,,
	50	009709	,,
	10	00746	Wijkander
	12	00739	,,
	20	00645	,,
	30	00561	,,
	40	00492	,,
	50	00433	,,
	60	00389	,,
	16·5	00688	W. König
	19·3	00523	,,
	10	07651	Pribram and Handl*
	15	07092	,,
Butyl	20	06587	,,
	25	06063	,,
	30	05684	,,
	40	05017	,,
	50	04403	,,
	20	00654	Gartenmeister
	10	014076	Pribram and Handl*
Buty	15	013173	,,
	20	012271	,,
	25	011369	,,
	30	010647	,,
	40	009564	,,
	50	008662	,,

TABLE LXXH. (1)—*continued.*

Liquid.	$t°$ C.	η	Authority.
Benzol (monochlor-), . .	10°	0·009582	Pribram and Handl*
	15	008969	,,
	20	008391	,,
	25	007904	,,
	30	007435	,,
	40	006659	,,
	50	005991	,,
Benzol (ethyl-), . . .	20	00686	Gartenmeister
Benzol (mononitro-), . .	15	022431	Pribram and Handl*
	20	020572	,,
	25	018731	,,
	30	017197	,,
	40	014363	,,
	50	012596	,,
Benzyl alcohol, . . .	20	05690	Gartenmeister
Benzyl chloride, . . .	15	015285	Pribram and Handl*
	20	014967	,,
	25	012740	,,
	30	011820	,,
	40	010258	,,
	50	008933	,,
Butane (*n*) (nitro-), . . .	10	012091	,,
	15	011278	,,
	20	010466	,,
	25	009745	,,
	30	009023	,,
	40	007940	,,
	50	007038	,,
Butane (*i*) (nitro-), . . .	10	012993	,,
	15	012091	,,
	20	011188	,,
	25	010466	,,
	30	009745	,,
	40	008481	,,
	50	007399	,,
Butyl (*n*) acetate, . . .	10	009384	,,
	15	008842	,,
	20	008301	,,
	25	007760	,,
	30	007218	,,
	40	006316	,,
	50	005504	,,
Butyl (*i*) acetate, . . .	10	008211	,,
	15	007579	,,
	20	007038	,,
	25	006587	,,
	30	006154	,,

TABLE LXXII. (1) *continued.*

Liquid.	t° C.	η	Authority.
Butyl (*i*) acetate, . . .	40°	0·005194	Pribram and Handl*
	50	001716	"
	20	00718	Gartenmeister
Butyl (*n*) alcohol, . . .	10	038455	Rellstab*
	15	034233	"
	20	030100	"
	25	026040	"
	30	022557	"
	40	016981	"
	50	011076	"
	10	042949	Pribram and Handl*
	15	037535	"
	20	032843	"
	25	028692	"
	30	025083	"
	40	018172	"
	50	015158	"
Butyl (*i*) alcohol, . . .	10	058648	"
	15	049625	"
	20	042046	"
	25	035730	"
	30	030497	"
	40	022557	"
	50	016963	"
	0	08275	Pagliani Battelli
	10	05593	"
	20	04008	Traube
	40	02186	"
	60	01279	"
	10	05797	Gartenmeister
	20	04112	"
	30	03008	"
	40	02230	"
	50	01704	"
Butyl (*n*) aldehyde, . . .	10	008121	Pribram and Handl*
	15	007399	"
	20	006677	"
	25	006136	"
	30	005594	"
	40	004872	"
	50	004150	"
Butyl (*i*) aldehyde, . . .	10	006587	"
	15	006045	"
	20	005504	"
	25	005053	"
	30	004692	"
	40	004150	"

TABLE LXXH. (1)—*continued.*

Liquid.	$t°$ C.	η	Authority.
Butyl (*i*) aldehyde, . . .	50°	0·003790	Pribram and Handl*
Butyl benzoate, . . .	10	041216	de Heen*
	30	022756	,,
	50	015465	,,
Butyl (*i*) bromide, . . .	10	007038	Pribram and Handl*
	15	006587	,,
	20	006226	,,
	25	005865	,,
	30	005594	,,
	40	005053	,,
	50	004602	,,
Butyl butyrate, . . .	10	011278	de Heen*
	30	008536	,,
	50	007020	,,
Butyl (*i*) chloride, . . .	10	005414	Pribram and Handl*
	15	005053	,,
	20	004782	,,
	25	004511	,,
	30	004241	,,
	40	003790	,,
	50	003429	,,
Butyl (*n*) formate, . . .	10	008301	,,
	15	007669	,,
	20	007038	,,
	25	006587	,,
	30	006226	,,
	40	005594	,,
	50	004963	,,
	20	00704	Gartenmeister
Butyl (*i*) formate, . . .	10	007940	Pribram and Handl*
	15	007399	,,
	20	006857	,,
	25	006406	,,
	30	005955	,,
	40	005233	,,
	50	004692	,,
	20	00680	Gartenmeister
Butyl (*n*) iodide, . . .	10	010466	Pribram and Handl*
	15	009835	,,
	20	009293	,,
	25	008752	,,
	30	008301	,,
	40	007399	,,
	50	006857	,,
Butyl (*i*) iodide, . . .	10	010015	,,
	15	009293	,,
	20	008662	,,

TABLE LXXII. (1)—*continued.*

Liquid.	$t°$ C.	η	Authority.
Butyl (*i*) iodide, . . .	25°	0·008214	Pribram and Handl[1]
	30	007760	,,
	40	006857	,,
	50	006226	,,
Butyl (*i*) nitrite, . . .	10	008572	,,
	15	007940	,,
	20	007399	,,
	25	006857	,,
	30	006406	,,
	40	005504	,,
	50	004692	,,
Butyl (*i*) propionate, . .	10	010015	,,
	15	009293	,,
	20	008572	,,
	25	008030	,,
	30	007489	,,
	40	006587	,,
	50	005865	,,
Butyric (*n*) acid, . . .	20	01525	Graham
	10	019886	Rellstab*
	15	018280	,,
	20	016674	,,
	25	015068	,,
	30	013967	,,
	40	011946	,,
	50	010394	,,
	10	020572	Pribram and Handl*
	15	018587	,,
	20	017053	,,
	25	015519	,,
	30	014256	,,
	40	012000	,,
	50	010286	,,
	20	01623	Traube
	40	01184	,,
	60	00911	,,
	10	01958	Gartenmeister
	20	01629	,,
	30	01365	,,
	40	01183	,,
	50	01025	,,
Butyric (*i*) acid, . . .	15	014924	Pribram and Handl*
	20	013787	,,
	25	012740	,,
	30	011748	,,
	40	010106	,,
	50	008752	,,

TABLE LXXH. (1)—*continued.*

Liquid.	$t°$ C.	η	Authority.
Butyric (i) acid,	20°	0·01326	Traube
	40	01004	,,
	60	00796	,,
Caproic acid,	20	03263	Gartenmeister
Caproic (i) acid,	10	040097	Rellstab*
	15	036163	,,
	20	032410	,,
	25	028512	,,
	30	025210	,,
	40	021131	,,
	50	017649	,,
Carbon dioxide,	5	000925	Warburg and v. Babo
	10	000852	,,
	15	000784	,,
	20	000712	,,
	25	000625	,,
	29	000539	,,
Carbon disulphide,	21·83	00534	v. Helmholtz and v. Piotrowski
	12	00393	Wijkander
	20	00370	,,
	25	00357	,,
	30	00344	,,
	35	00332	,,
	15	00388	W. König
Carbon tetrachloride,	10	011730	Pribram and Handl*
	15	010827	,,
	20	010106	,,
	25	009384	,,
	30	008662	,,
	40	007579	,,
	50	006677	,,
	10	011008	,,
	30	008301	,,
	50	006316	,,
	20	01019	Gartenmeister
Chloroform,	10	006496	Pribram and Handl*
	15	006136	,,
	20	005775	,,
	25	005504	,,
	30	005233	,,
	40	004692	,,
	50	004331	,,
	12	00617	Wijkander
	20	00568	,,
	25	00539	,,
	30	00513	,,

TABLE LXXII. (1) *continued.*

Liquid.	t° C	η	Authority.
Chloroform,	35°	0·00489	Wijkander
	40	00467	"
	20	00568	Gartenmeister
Chlorpicrin,	10	013715	Pribram and Handl*
	15	012812	"
	20	011910	"
	25	011008	"
	30	010286	"
	40	009023	"
	50	008121	"
Cresol,	20	1878	Gartenmeister
Decane,	22·3	00775	Bartoli and Stracciati
Diallyl,	20	00280	Gartenmeister
Diethylketone,	20	00478	"
Dodecane,	23·3	01257	Bartoli and Stracciati
Ethane (nitro),	10	008121	Pribram and Handl
	15	007579	"
	20	007218	"
	25	006857	"
	30	006196	"
	40	005775	"
	50	005233	"
Ethyl acetate,	20	00561	Graham
	10	005396	Rellstab*
	15	005143	"
	20	005017	"
	25	004728	"
	30	004511	"
	40	004078	"
	50	003663	"
	10	005197	Pribram and Handl*
	15	004818	"
	20	004511	"
	25	004259	"
	30	004006	"
	40	003591	"
	50	003230	"
	20	00460	Gartenmeister
Ethyl alcohol,	10	015032	Graham*
	20	01211	"
	30	01005	"
	50	007128	"
	10	014852	" (2)
	30	010142	"
	50	007146	"
	24·05	013754	v. Helmholtz and v. Piotrows
	10	015555	Rellstab*

TABLE LXXH. (1)—*continued.*

Liquid.	$t°$ C.	η	Authority.
Ethyl alcohol, . . .	30°	0·010611	Rellstab*
	50	007345	,,
	10	01525	Wijkander
	12	01482	,,
	20	01257	,,
	25	01138	,,
	30	01034	,,
	40	00856	,,
	50	00715	,,
	0	01843	Pagliani and Battelli
Ethyl benzoate, . . .	10	026852	Rellstab*
	30	017685	,,
	50	012559	,,
	20	02285	Gartenmeister
Ethyl bromide, . . .	10	004331	Pribram and Handl*
	15	004060	,,
	20	003790	,,
	25	003609	,,
	30	003519	,,
Ethyl butyrate (n), . . .	20	00760	Graham
	10	006893	Rellstab*
	15	006569	,,
	20	006244	,,
	25	005919	,,
	30	005594	,,
	40	004944	,,
	50	004295	,,
	10	007742	Pribram and Handl*
	15	007290	,,
	20	006839	,,
	25	006388	,,
	30	005937	,,
	40	005215	,,
	50	004638	,,
	10	007146	De Heen*
	30	005720	,,
	50	004854	,,
	20	00681	Gartenmeister
Ethyl butyrate (i), . . .	10	007399	Pribram and Handl*
	15	006857	,,
	20	006316	,,
	25	005955	,,
	30	005594	,,
	40	004872	,,
	50	004511	,,
	20	00601	Gartenmeister
Ethyl chloracetate . . .	10	01525	Pribram and Handl*

TABLE LXXH. (1)—*continued.*

Liquid.	$t°$ C.	η	Authority.
Ethyl chloracetate, ...	15°	0·014076	Pribram and Handl*
	20	012993	”
	25	011910	”
	30	011008	”
	40	009564	”
	50	008301	”
Ethyl ether, ...	14·5	00346	Poiseuille
	21·6	00592	v. Helmholtz and v. Piotrowski
	10	003483	Rellstab*
	15	003465	”
	20	003447	”
	25	003429	”
	30	003411	”
	10	002617	Pribram and Handl*
	15	002490	”
	20	002364	”
	25	002238	”
	30	002111	”
	10	00285	Wijkander
	12	00278	”
	15	00270	”
	20	00258	”
	25	00245	”
	30	00233	”
	20	002543	Sachs
	15	00256	W. König
	20	00242	Gartenmeister
Ethyl formate, ...	20	00518	Graham
	10	005017	Rellstab*
	15	004782	”
	20	004566	”
	25	004331	”
	30	004096	”
	40	003663	”
	50	003194	”
	10	004602	Pribram and Handl*
	15	004331	”
	20	004078	”
	25	003844	”
	30	003627	”
	40	003248	”
	50	003086	”
	20	00411	Gartenmeister
Ethyl iodide, ...	10	006496	Pribram and Handl*
	15	006136	”
	20	005775	”
	25	005414	”

TABLE LXXH. (1)—*continued*.

Liquid.	$t°$ C.	η	Authority.
Ethyl iodide, ...	30°	0·005233	Pribram and Handl*
	40	004872	,,
	50	004511	,,
	20	00593	Gartenmeister
Ethyl mercaptan, . . .	10	004331	Pribram and Handl*
	15	004060	,,
	20	003790	,,
	25	003609	,,
	30	003519	,,
Ethyl propionate, . . .	10	006587	,,
	15	006136	,,
	20	005775	,,
	25	005414	,,
	30	005053	,,
	40	004692	,,
	50	004331	,,
	20	00548	Gartenmeister
Ethyl sulphide, . . .	10	004872	Pribram and Handl*
	15	004602	,,
	20	004331	,,
	25	004150	,,
	30	003970	,,
	40	003609	,,
	50	003248	,,
Ethyl valerate (*i*), . . .	20	00838	Graham
	10	008662	Rellstab
	15	008229	,,
	20	007796	,,
	25	007363	,,
	30	006929	,,
	40	006063	,,
	50	005396	,,
	10	009059	Pribram and Handl*
	15	008427	,,
	20	007832	,,
	25	007254	,,
	30	006713	,,
	40	005811	,,
	50	005143	,,
	20	00857	Gartenmeister
Ethylene bromide, . . .	15	018659	Pribram and Handl*
	20	017179	,,
	25	016061	,,
	30	015068	,,
Ethylene chloride, . . .	15	008987	,,
	20	008391	,,
	25	007850	,,

TABLE LXXII. (1)—*continued.*

Liquid.	$t°$ C.	η	Authority.
Ethylene chloride, . . .	30°	0·007308	Pribram and Handl*
	40	006424	"
	50	005720	"
Ethylene glycol, . . .	55	063160	"
Ethylidene chloride, . .	10	005775	"
	15	005504	"
	20	005233	"
	25	004963	"
	30	004692	"
	40	004331	"
	50	003970	"
Formic acid, . . .	10	022106	Rellstab*
	15	019796	"
	20	017901	"
	25	016187	"
	30	014743	"
	40	012307	"
	50	010286	"
	20	01959	Traube
	40	01291	"
	60	00909	"
	10	02306	Gartenmeister
	20	01839	"
	30	01493	"
	40	01248	"
	50	01045	"
Glycerol, ...	2·8	42·20	Schottner
	3·7	39·52	"
	7·4	26·83	"
	8·1	25·18	"
	14·3	13·87	"
	13·6	14·79	"
	20·3	8·304	"
	20·9	7·776	"
	25·6	5·413	"
	26·5	4·939	"
Heptane, ...	24	0·00449	Bartoli and Stracciati
	24·4	00446	"
Heptyl alcohol, ...	20	0715	Gartenmeister
Hexadecane, ...	22·2	03591	Bartoli and Stracciati
Hexane, ...	23·7	00329	"
	20	00315	Gartenmeister
Mercury, ...	– 21·4	01847	S. Koch
	– 18·1	01823	"
	17	01602	Warburg
	10	02977	Villari
	17·1	01543	Th. Schmidt

TABLE LXXH. (1)—*continued.*

Liquid.	$t°$ C.	η	Authority.
Mercury,	0°	0·01697	S. Koch
	10·1	01631	,,
	11·5	01625	,,
	12·5	01618	,,
	16·7	01592	,,
	18·3	01582	,,
	99	01223	,,
	124	01152	,,
	154	01090	,,
	176·2	01045	,,
	196·7	01017	,,
	237·8	00972	,,
	249	009652	,,
	263	009540	,,
	272	009477	,,
	282	009411	,,
	316	009160	,,
	340·1	009054	,,
Methyl acetate,	10	004746	Rellstab*
	15	004511	,,
	20	004295	,,
	25	004078	,,
	30	003862	,,
	40	003411	,,
	50	002959	,,
	10	004692	Pribram and Handl*
	15	004421	,,
	20	004150	,,
	25	003880	,,
	30	003609	,,
	40	003248	,,
	50	003068	,,
	20	00391	Gartenmeister
Methyl alcohol,	20	00638	Graham
	10	007037	Rellstab*
	15	006677	,,
	20	006352	,,
	25	006045	,,
	30	005720	,,
	40	005017	,,
	50	004295	,,
	0	00734	Pagliani and Battelli
	10	00654	,,
	20	00607	Traube
	30	00541	,,
	40	00463	,,
	50	00406	,,

TABLE LXXH. (1)—*continued.*

Liquid.	$t°$ C.	η	Authority
Methyl alcohol,	60°	0·00361*	Traube
	10	00729	Gartenmeister
	20	00623	,,
	30	00540	,,
	40	00473	,,
	50	00414	,,
Methyl benzoate,	10	023513	Rellstab*
	15	021709	,,
	20	019886	,,
	25	018082	,,
	30	016259	,,
	40	013570	,,
	50	011585	,,
	10	023676	de Heen*
	30	015555	,,
	50	011278	,,
	20	02099	Gartenmeister
Methyl butyrate (n),	10	006406	Rellstab*
	15	006099	,,
	20	005775	,,
	25	005468	,,
	30	005161	,,
	40	004529	,,
	50	003916	,,
	10	007597	de Heen*
	30	006334	,,
	50	005486	,,
	20	00588	Gartenmeister
Methyl butyrate (i),	10	006316	Pribram and Handl*
	15	005955	,,
	20	005594	,,
	25	005233	,,
	30	004963	,,
	40	004511	,,
	50	004150	,,
	20	00527	Gartenmeister
Methyl formate,	20	00355	,,
Methyl iodide,	10	005684	Pribram and Handl*
	15	005504	,,
	20	005233	,,
	25	005143	,,
	30	004872	,,
	40	004421	,,
	20	00500	Gartenmeister
Methyl propionate,	10	005594	Pribram and Handl*
	15	005233	,,
	20	004872	,,

TABLE LXXII. (1)—*continued.*

Liquid.	t° C.	η	Authority.
Methyl propionate, . . .	25°	0·004692	Pribram and Handl*
	30	004421	"
	40	003970	"
	50	003609	"
	20	00470	Gartenmeister
Methyl propyl ether, . .	20	00256	"
Methyl salicylic acid, . .	10	032446	Rellstab*
	15	029974	"
	20	027501	"
	25	025047	"
	30	022575	"
	40	018352	"
	50	015194	"
Methyl valerate (*n*), . .	20	00727	Gartenmeister
" (*i*), . . .	10	007363	Pribram and Handl*
	15	007038	"
	20	006731	"
	25	006406	"
	30	006081	"
	40	005450	"
	50	004818	"
Methylene chloride, . . .	20	00439	Gartenmeister
Nitric acid, ...	20	01003	Graham
	0	02273	Pagliani and Oddone
	10	01770	"
Nonane, ...	22·3	00619	Bartoli and Stracciati
Octane, ...	22·2	00526	"
Octyl alcohol, ...	20	0912	Gartenmeister
Pentadecane, ...	22	02814	Bartoli and Stracciati
Pentane, ...	21	00261	"
Petroleum, ...	17·5	019	Petroff
Phenetol, ...	20	01286	Gartenmeister
Propane (*n*) nitro-, . . .	10	010015	Pribram and Handl*
	15	009384	"
	20	008842	"
	25	008301	"
	30	007760	"
	40	006857	"
	50	006226	"
Propane (*i*) nitro-, . . .	10	008481	"
	15	007940	"
	20	007399	"
	25	007038	"
	30	006587	"
	40	005775	"
	50	005053	"

TABLE LXXH. (1)—*continued.*

Liquid.	$t°$ C.	η	Authority.
Propionic acid, . . .	10°	0·012686	Rellstab*
	15	011766	,,
	20	010881	,,
	25	010051	,,
	30	009293	,,
	40	008175	,,
	50	007381	,,
	10	014075	Pribram and Handl*
	15	012993	,,
	20	012000	,,
	25	011098	,,
	30	010286	,,
	40	009203	,,
	50	008121	,,
	20	01156	Traube
	40	00901	,,
	60	00736	,,
	20	01125	Gartenmeister
Propyl (n) acetate, . . .	10	006677	Pribram and Handl*
	15	006316	,,
	20	005955	,,
	25	005594	,,
	30	005233	,,
	40	004511	,,
	50	003970	,,
	20	00608	Gartenmeister
Propyl (i) acetate, . . .	10	006496	Pribram and Handl*
	15	006136	,,
	20	005775	,,
	25	005414	,,
	30	005053	,,
	40	004421	,,
	50	003970	,,
	20	00536	Gartenmeister
Propyl (n) alcohol, . . .	10	020175	Rellstab*
	15	018641	,,
	20	016963	,,
	25	015447	,,
	30	013859	,,
	40	011297	,,
	50	009131	,,
	15	026888	Pribram and Handl*
	20	023640	,,
	25	020752	,,
	30	018046	,,
	40	014256	,,
	50	011369	,,

TABLE LXXh. (1)—*continued.*

Liquid.	$t°$ C.	η	Authority.
Propyl (*n*) alcohol, . . .	10°	0·031580	Pribram and Handl*
	15	028151	"
	20	024722	"
	25	021835	"
	30	018948	"
	40	014978	"
	50	012271	"
	0	04170	Pagliani and Battelli
	10	03119	"
	20	02327	Traube
	30	01818	"
	40	01434	"
	50	01166	"
	60	00949	"
	10	02934	Gartenmeister
	20	02273	"
	30	01791	"
	40	01416	"
	50	01148	"
Propyl (*i*) alcohol, . . .	10	030678	Pribram and Handl*
	15	026707	"
	20	023098	"
	25	020211	"
	30	017685	"
	40	013354	"
	50	010466	"
	20	02543	Traube
	30	01878	"
	40	01427	"
	50	01005	"
	60	00880	"
	10	03383	Gartenmeister
	20	02479	"
	30	01846	"
	40	01403	"
	50	01083	"
Propyl aldehyde, . . .	10	004782	Pribram and Handl*
	15	004421	"
	20	004150	"
	25	003880	"
	30	003699	"
	40	003338	"
Propyl benzoate, . . .	10	037174	"
	15	032663	"
	20	028512	"
	25	025625	"
	30	022737	"

TABLE LXXH. (1)—*continued.*

Liquid.	t° C.	η	Authority.
Propyl benzoate, . . .	40°	0·018767	Pribram and Handl*
	50	015880	,,
Propyl (*n*) bromide, . .	10	005648	,,
	15	005414	,,
	20	005179	,,
	25	004963	,,
	30	004728	,,
	40	004259	,,
	20	00545	Gartenmeister
Propyl (*i*) bromide, . . .	10	005775	Pribram and Handl*
	15	005594	,,
	20	005323	,,
	25	005053	,,
	30	004872	,,
	40	004421	,,
	50	003970	,,
Propyl (*n*) butyrate (*n*), . .	10	010466	,,
	15	009564	,,
	20	008842	,,
	25	008301	,,
	30	007760	,,
	40	006677	,,
	50	005955	,,
	20	00847	Gartenmeister
Propyl (*n*) butyrate (*i*), . .	10	009564	Pribram and Handl*
	15	008842	,,
	20	008211	,,
	25	007669	,,
	30	007218	,,
	40	006316	,,
	50	005684	,,
	20	00755	Gartenmeister
Propyl (*i*) butyrate (*n*), . .	10	009384	Pribram and Handl*
	15	008662	,,
	20	007940	,,
	25	007399	,,
	30	006948	,,
	40	006226	,,
	50	005414	,,
Propyl (*i*) butyrate (*i*), . .	10	008572	,,
	15	007760	,,
	20	007218	,,
	25	006857	,,
	30	006496	,,
	40	005775	,,
	50	005053	,,
Propyl (*n*) chloride, . . .	10	003880	,,

TABLE LXXH. (1)—*continued.*

Liquid.	$t°$ C.	η	Authority.
Propyl (n) chloride, . . .	15°	0·003717	Pribram and Handl*
	20	003536	,,
	25	003356	,,
	30	003194	,,
	40	002833	,,
Propyl (i) chloride, . . .	10	003970	,,
	15	003790	,,
	20	003609	,,
	25	003429	,,
	30	003248	,,
Propyl ether, ...	20	00433	Gartenmeister
Propyl (n) formate, . . .	10	006045	Pribram and Handl*
	15	005594	,,
	20	005233	,,
	25	004963	,,
	30	004692	,,
	40	004150	,,
	50	003790	,,
	20	00574	Gartenmeister
Propyl (i) formate, . . .	10	005775	Pribram and Handl*
	15	005414	,,
	20	005053	,,
	25	004782	,,
	30	004511	,,
	40	004060	,,
	50	003609	,,
	20	00522	Gartenmeister
Propyl (n) iodide, . . .	10	008517	Pribram and Handl*
	15	008084	,,
	20	007651	,,
	25	007218	,,
	30	006805	,,
	40	005937	,,
	50	005071	,,
	20	00757	Gartenmeister
Propyl (i) iodide, . . .	10	008481	Pribram and Handl*
	15	007940	,,
	20	007399	,,
	25	007038	,,
	30	006677	,,
	40	005775	,,
	50	005233	,,
Propyl (n) nitrite, . . .	10	004511	,,
	15	004331	,,
	20	004150	,,
	25	003970	,,
	30	003790	,,

TABLE LXXII. (1)—*continued.*

Liquid.	$t°$ C.	η	Authority.
Propyl (n) nitrite,	40°	0·003429	Pribram and Handl*
	50	003068	,,
Propyl (n) propionate,	10	008662	,,
	15	007940	,,
	20	007399	,,
	25	006857	,,
	30	006496	,,
	40	005775	,,
	50	005233	,,
	20	00686	Gartenmeister
Propyl (i) propionate,	10	007579	Pribram and Handl*
	15	007038	,,
	20	006677	,,
	25	006316	,,
	30	005955	,,
	40	005233	,,
	50	004692	,,
Propyl (n) valerate,	20	01073	Gartenmeister
Propylene glycol,	20	4566	,,
Rape oil,	0	25·3	O. E. Meyer
	6·5	5·18	,,
	12·4	3·08	,,
	13·9	2·82	,,
	18·1	1·69	,,
	27	1·20	,,
	29·5	0·96	,,
	31·6	0·90	,,
Salicyl aldehyde,	10	0·032446	Rellstab*
	15	029974	,,
	20	027501	,,
	25	025029	,,
	30	022575	,,
	40	018352	,,
	50	015194	,,
Sulphuric acid,	11·2	31953	Poiseuille
	20	21929	Graham
Tetradecane,	21·9	02131	Bartoli and Stracciati
Toluol,	10	006893	Pribram and Handl*
	15	006388	,,
	20	005973	,,
	25	005612	,,
	30	005287	,,
	40	004728	,,
	50	004295	,,
	10	006911	de Heen
	30	005847	,,
Toluol, monochlor-,	10	011333	Pribram and Handl*

TABLE LXXH (1)—*continued.*

Liquid.	$t°$ C.	η	Authority.
Toluol, monochlor-,	15°	0·010557	Pribram and Handl*
	20	009853	,,
	25	009149	,,
	30	008572	,,
	40	007561	,,
	50	006695	,,
Toluol (*o*), mononitro-,	15	025986	,,
	20	023622	,,
	25	021276	,,
	30	019309	,,
	40	016133	,,
	50	013805	,,
Tridecane,	23·3	01550	Bartoli and Stracciati
Turpentine,	11·9	001865	W. König
Undecane,	22·7	00947	Bartoli and Stracciati
Valeral,	10	007164	Rellstab*
	15	006839	,,
	20	006514	,,
	25	006189	,,
	30	005847	,,
	40	005197	,,
	50	004529	,,
Valeral (*i*),	10	007128	Pribram and Handl*
	15	006587	,,
	20	006136	,,
	25	005775	,,
	30	005504	,,
	40	004963	,,
	50	004421	,,
Valeric (*i*) acid,	20	02183	Graham
	10	027501	Rellstab*
	15	024921	,,
	20	022394	,,
	25	020518	,,
	30	018641	,,
	40	015664	,,
	50	012903	,,
	20	02411	Traube
	40	01672	,,
	60	01235	,,
	20	02279	Gartenmeister
Water,	0	01775	Poiseuille*
	0	018142	,,
	0	01778	,,
	0	01782	,,
	0	017987	Hagen
	0	01573	Grotrian

TABLE LXXH. (1)—*continued.*

Liquid.	$t°$ C.	η	Authority.
Water, ...	0°	0·01854	Rosencranz
	0	018507	Pribram and Handl*
	0	01775	Pagliani and Battelli
	0	01811	Noack
	0	017995	"
	0	0183	O. E. Meyer
	0	0180456	Calculated most probable value
	10	013263	Poiseuille*
	20	010232	"
	30	008157	"
	40	006677	"
	50	005558	"
	10	013276	Graham (1)
	20	010097	"
	30	008066	"
	40	006648	"
	50	005607	"
	60	004898	"
	10	013161	" (2)
	20	010113	"
	30	008122	"
	40	006668	"
	50	005594	"
	60	004852	"
	10	013264	Rellstab*
	20	010015	"
	30	008121	"
	40	006713	"
	50	005630	"
	10	013206	Sprung*
	20	010147	"
	30	008146	"
	40	006691	"
	50	005638	"
	60	004829	"
	17	01106	Grotrian
	20	010183	Slotte*
	30	008166	"
	40	006664	"
	13·62	011836	Stephan
	13·92	011748	"
	14·50	011607	"
	20·13	010241	"
	25·67	008865	"
	27·02	008692	"
	30	007878	"

TABLE LXXH. (1)—*continued.*

Liquid.	$t°$ C.	η	Authority.
Water,	12°·9	0·01258	Th. Schmidt
	20	010142	Wagner*
	30	008048	,,
	40	006623	,,
	50	005720	,,
	15	01124	Sachs
	17	011085	W. König
	17·5	0105	Petroff
	24·7	00912	Arrhenius
	17	01105	W. König
	10	01309	Couette
	12	01288	,,
	20	01032	Gartenmeister
	19·1	01031	Schwedoff
	15	011439	Bruckner
	20	010086	,,
	20	010141	Mutzel
	5	015320	Thorpe and Rodger*
	10	013220	,,
	15	011504	,,
	20	010165	,,
	25	009043	,,
	30	008094	,,
	35	007307	,,
	40	006633	,,
	45	006059	,,
	50	005557	,,
	55	005130	,,
	60	004750	,,
	65	004420	,,
	70	004121	,,
	75	003852	,,
	80	003613	,,
	85	003400	,,
	90	003202	,,
	95	003030	,,
	100	002872	,,
Xylol (*m*),	10	007651	Pribram and Handl*
	20	006659	,,
	25	006262	,,
	30	005901	,,
	40	005251	,,
	50	004764	,,
	10	007651	de Heen*
	30	005558	,,

TABLE LXXH. (2).—**Values of η for Mixed Liquids and Solutions.**

Substance dissolved.	Concentration.	$t°$ C.	η	Authority.
Mixed liquids (with water)—				
Acetic acid,	99·8%	10°	0·014779	Noack*
	,,	15	013679	,,
	,,	20	012650	,,
	,,	25	011712	,,
	,,	30	010863	,,
	,,	40	009366	,,
	,,	50	008102	,,
	99·6%	20	01455	Traube
	,,	40	01035	,,
	,,	60	00797	,,
	99·2%	20	01297	Graham
	Normal	25	01012	Reyher*
Alcohol (ethylic),	70%	10	03279	Stephan
	,,	15	02789	,,
	,,	20	02368	,,
	,,	25	02069	,,
	,,	30	01809	,,
	49 %	10	04133	,,
	,,	15	03464	,,
	,,	20	02964	,,
	,,	25	02537	,,
	,,	30	02194	,,
	35·11 %	10	05703	,,
Butyric acid,	Normal	25	01164	Reyher*
,, ,, (iso),	,,	25	01157	,,
Chloric acid,	,,	25	00956	,,
Formic acid,	,,	25	00938	,,
Glycerol,	94·46 %	8·5	7·437	Schöttner
	89·94 ,,	8·3	3·553	,,
	80·31 ,,	8.5	1·021	,,
	74·97 ,,	5·9	0·6671	,,
	,, ,,	6·2	6523	,,
	,, ,,	14·9	3900	,,
	,, ,,	21·1	2803	,,
	64·05 ,,	8·5	2221	,,
	49·79 ,,	8·5	0925	,,
Hydrochloric acid,	23·045 %	15	01657	Wagner*
	,,	25	01388	,,
	,,	45	01017	,,
	16·125 %	15	01443	,,
	,,	25	01201	,,
	,,	45	008678	,,
	8·14 %	15	01281	,,
	,,	25	01046	,,
	,,	45	007236	,,
	Normal	25	01290	Reyher*

TABLE LXXH. (2)—*continued.*

Substance in Solution.	Concentration.	$t°$ C.	η	Authority.
Lactic acid,	Normal	25°	0·01147	Reyher*
Nitric acid,	28·31 %	15	01450	Wagner*
	,,	25	011814	,,
	,,	45	008346	,,
	18·20 %	15	012551	,,
	,,	25	010338	,,
	,,	45	007341	,,
	8·37 %	15	011984	,,
	,,	25	009894	,,
	,,	45	006783	,,
	Normal	25	012896	Reyher*
Perchloric acid,	,,	25	009113	,,
Propionic acid,	,,	25	011010	,,
Sulphuric acid,	23·429 %	15	022144	Wagner*
	,,	25	017234	,,
	,,	45	011598	,,
	15·503 %	15	017156	,,
	,,	25	013532	,,
	,,	45	008981	,,
	7·875 %	15	014041	,,
	,,	25	011001	,,
	,,	45	007523	,,
Solutions—				
Ammonium chloride,	23·37 %	10	012172	Sprung*
	,,	30	008601	,,
	,,	50	006507	,,
	15·678 %	10	012145	,,
	,,	30	008342	,,
	,,	50	006137	,,
	8·671 %	10	012464	,,
	,,	30	008180	,,
	,,	50	005886	,,
	3·67 %	10	012895	,,
	,,	30	008117	,,
	,,	50	005757	,,
	Normal	17·6	010427	Arrhenius*
	,,	17·6	010560	Kreichgauer*
Cæsium chloride,	,,	25	008888	Wagner*
Lithium chloride,	26·93 %	10	041397	Sprung*
	,,	30	025643	,,
	,,	50	017685	,,
	13·91 %	10	021889	,,
	,,	30	013697	,,
	,,	50	009492	,,
	7·757 %	10	017342	,,
	,,	30	010773	,,
	,,	50	007435	,,

TABLE LXXII. (2)—*continued.*

Substance in Solution.	Concentration.	$t°$ C.	η	Authority.
Lithium chloride, . . .	Normal	17·6	0·012731	Arrhenius*
	,,	17·6	012764	Kreichgauer*
	,,	25	010710	Wagner*
Potassium chloride, . .	22·215 %	10	012641	Sprung*
	,,	30	008780	,,
	,,	50	006565	,,
	10·230 %	10	012641	,,
	,,	30	008312	,,
	,,	50	005979	,,
	Normal	17·6	010673	Arrhenius*
	,,	20	010207	Mützel*
	,,	25	008976	Wagner*
Rubidium chloride, . .	,,	25	008952	,,
Sodium chloride, . .	23·219 %	10	023152	Sprung*
	,,	30	014335	,,
	,,	50	008550	,,
	14·312 %	10	017100	,,
	,,	30	010840	,,
	,,	50	006661	,,
	7·955 %	10	014868	,,
	,,	30	009389	,,
	,,	50	005742	,,
	Normal	17·6	011928	Arrhenius*
	,,	17·6	011786	Kreichgauer*
	,,	20	011349	Mützel*
	,,	25	009976	Reyher*
Barium chloride, . . .	24·34 %	10	018172	Sprung*
	,,	30	011946	,,
	,,	50	008608	,,
	15·402 %	10	015754	,,
	,,	30	010106	,,
	,,	50	007146	,,
	7·605 %	10	014058	,,
	,,	30	007940	,,
	,,	50	006352	,,
	Normal	17·6	013215	Arrhenius*
	,,	17·6	013251	Kreichgauer*
	,,	20	014550	Mützel*
	,,	25	010208	Wagner*
Cadmium chloride, . .	24·786 %	15	018771	,,
	,,	25	014503	,,
	,,	45	009669	,,
	16·30 %	15	016050	,,
	,,	25	012717	,,
	,,	45	008519	,,
	11·09 %	15	013978	,,
	,,	25	010923	,,

TABLE LXXH. (2)—*continued.*

Substance in Solution.	Concentration.	$t°$ C.	η	Authority.
Cadmium chloride, . . .	11·09 %	45°	0·007350	Wagner*
	Normal	25	010312	,,
Calcium chloride, . . .	44·087 %	30	107028	Sprung*
	,,	50	065542	,,
	39·75 %	10	120924	,,
	,,	30	068393	,,
	,,	50	044302	,,
	31·60 %	10	049174	,,
	,,	30	031941	,,
	,,	50	022377	,,
	15·17 %	10	020013	,,
	,,	30	012866	,,
	,,	50	009077	,,
	Normal	20	014008	Mützel*
	,,	25	010933	Wagner*
Cobalt chloride, . . .	22·270 %	15	029162	,,
	,,	25	022846	,,
	,,	45	014902	,,
	14·858 %	15	020139	,,
	,,	25	015359	,,
	,,	45	010604	,,
	7·970 %	15	014979	,,
	,,	25	011742	,,
	,,	45	008095	,,
	Normal	25	010948	,,
Cupric chloride, . . .	33·027 %	15	032193	,,
	,,	25	024795	,,
	,,	45	015714	,,
	21·349 %	15	022467 to 021186	,,
	,,	25	017297	,,
	,,	45	011414	,,
	12·006 %	15	015732	,,
	,,	25	012238	,,
	,,	45	008225	,,
	Normal	25	010956	,,
Magnesium chloride, . .	,,	20	014197	Mützel
	,,	25	011360	Wagner
Manganese chloride, . .	40·132 %	15	096959	,,
	,,	25	070991	,,
	,,	45	044446	,,
	30·33 %	15	046251	,,
	,,	25	034864	,,
	,,	45	022322	,,
	15·650 %	15	023622	,,
	,,	25	018803	,,
	,,	45	012396	,,

TABLE LXXH. (2)—*continued.*

Substance in Solution.	Concentration.	$t°$ C.	η	Authority.
Manganese chloride, . .	8·007 %	15°	0·016748	Wagner
	,,	25	012834	,,
	,,	45	008682	,,
	Normal	25	011541	,,
Mercuric chloride, . . .	3·55 %	10	013850	,,
	,,	30	008401	,,
	,,	45	006910	,,
	0·226 %	30	008442	,,
	,,	40	006910	,,
Nickel chloride, . . .	30·4 %	15	041415	,,
	,,	25	031002	,,
	,,	45	020200	,,
	22·690 %	15	025282	,,
	,,	25	019778	,,
	,,	45	013121	,,
	11·449 %	15	016313	,,
	,,	25	012637	,,
	,,	45	008707	,,
	Normal	25	011508	,,
Strontium chloride, . .	31·62 %	10	030750	Sprung*
	,,	30	020518	,,
	,,	50	014653	,,
	21·45 %	10	020355	,,
	,,	30	013264	,,
	,,	50	009474	,,
	12·53 %	10	016313	,,
	,,	30	010466	,,
	,,	50	007417	,,
	7·18 %	10	014725	,,
	,,	30	009257	,,
	,,	50	006568	,,
	Normal	20	014533	Mützel*
	,,	25	011205	Wagner*
Zinc chloride, . . .	33·752 %	15	027375	,,
	,,	25	021276	,,
	,,	45	013108	,,
	23·487 %	15	020121	,,
	,,	25	015631	,,
	,,	45	010374	,,
	15·334 %	15	016892	,,
	,,	25	013126	,,
	,,	45	008700	,,
	Normal	17·6	013689	Arrhenius*
	,,	17·6	013591	Kreichgauer*
	,,	25	011405	Wagner*
Ammonium bromide, . .	36·833 %	10	011260	Sprung*

TABLE LXXH. (2)—*continued.*

Substance in Solution.	Concentration.	$t°$ C.	η	Authority.
Ammonium bromide, . .	36·833 %	30°	0·008048	Sprung*
	,,	50	006190	,,
	25·33 %	10	011297	,,
	,,	30	007814	,,
	,,	50	005811	,,
	15·97 %	10	011766	,,
	,,	30	007796	,,
	,,	50	005684	,,
Potassium bromide, . .	34·639 %	10	012018	,,
	,,	30	008481	,,
	,,	50	006442	,,
	23·164 %	10	011964	,,
	,,	30	008664	,,
	,,	50	005991	,,
	14·023 %	10	012199	,,
	,,	30	008084	,,
	,,	50	005793	,,
Sodium bromide, . . .	27·266 %	10	017306	,,
	,,	30	011134	,,
	,,	50	008012	,,
	18·579 %	10	014906	,,
	,,	30	009654	,,
	,,	50	006893	,,
	9·775 %	10	013642	,,
	,,	30	008788	,,
	,,	50	006208	,,
	Normal	25	010447	Reyher*
Potassium iodide, . . .	54 %	10	012415	Sprung*
	,,	30	008752	,,
	,,	50	006785	,,
	45·98 %	10	011369	,,
	,,	30	008157	,,
	,,	50	006370	,,
	33·035 %	10	011152	,,
	,,	30	007742	,,
	,,	50	005847	,,
	17·015 %	10	011784	,,
	,,	30	007742	,,
	,,	50	005666	,
	8·419 %	10	012542	,,
	,,	30	007940	,,
	,,	50	005648	,,
	Normal	17·6	011346	Arrhenius*
Sodium iodide, . . .	,,	17·6	011570	Kreichgauer*
	55·47 %	10	028367	Sprung*
	,,	30	017396	,,
	,,	50	012072	,,

TABLE LXXH. (2)—*continued.*

Substance in Solution.	Concentration.	$t°$ C.	η	Authority.
Sodium iodide, . . .	35·686 %	10°	0·015519	Sprung*
	"	30	010051	"
	"	50	007327	"
	17·15 %	10	013318	"
	"	30	008554	"
	"	50	006081	"
	8·829 %	10	013191	"
	"	30	008301	"
	"	50	005847	"
Potassium chlorate, . .	5·687 %	30	008120	"
	"	50	005666	"
	3·506 %	10	012939	"
	"	30	008066	"
	"	50	005684	"
Sodium chlorate, . . .	33·543 %	10	021835	"
	"	30	013661	"
	"	50	009564	"
	20·59 %	10	016043	"
	"	30	010250	"
	"	50	007290	"
	11·50 %	10	014202	"
	"	30	009023	"
	"	50	006370	"
Ammonium nitrate, . .	49·83 %	10	015898	"
	"	30	011423	"
	"	50	008824	"
	37·22 %	10	012939	"
	"	30	009239	"
	"	50	007002	"
	27·08 %	10	012091	"
	"	30	008608	"
	"	50	006298	"
	12·19 %	10	012054	"
	"	30	007994	"
	"	50	005756	"
	5·975 %	10	012559	"
	"	30	007994	"
	"	50	005702	"
Potassium nitrate, . . .	17·60 %	10	012415	"
	"	30	008301	"
	"	50	006027	"
	12·19 %	10	012397	"
	"	30	008084	"
	"	50	005829	"
	6·316 %	10	012776	"
	"	30	008048	"
	"	50	005738	"

TABLE LXXh. (2)—*continued.*

Substance in Solution.	Concentration.	$t°$ C.	η	Authority.
Potassium nitrate, . . .	76·76 %	0°	0·0155	O. E. Meyer
	11·81 ,,	0	0166	,,
	9·70 ,,	0	0169	,,
	4·79 ,,	0	0179	,,
	Normal	17·6	011125	Arrhenius*
	,,	17·6	011252	Kreichgauer*
	,,	20	010808	Mützel*
	,,	25	009426	Wagner*
Silver nitrate, . . .	,,	25	011058	,,
Sodium nitrate, . . .	31·547 %	10	021871	Sprung*
	,,	30	013751	,,
	,,	50	009636	,,
	18·20 %	10	015700	,,
	,,	30	010087	,,
	,,	50	007092	,,
	12·35 %	10	014653	,,
	,,	30	009203	,,
	,,	50	006514	,,
	7·25 %	10	013480	,,
	,,	30	008644	,,
	,,	50	006099	,,
	57·11 %	0	0291	O. E. Meyer
	35·26 ,,	0	0233	,,
	16·31 ,,	0	0191	,,
	Normal	17·6	012158	Arrhenius*
	,,	17·6	012262	Kreichgauer*
	,,	20	012003	Mützel*
	,,	25	010269	Reyher*
Barium nitrate, . . .	5·24 %	15	012282	Wagner*
	,,	25	009788	,,
	,,	45	006652	,,
	2·98 %	15	011190	,,
	,,	25	009229	,,
	,,	45	006283	,,
Cadmium nitrate, . . .	22·36 %	15	015359	,,
	,,	25	012457	,,
	,,	45	008577	,,
	15·71 %	15	012957	,,
	,,	25	010602	,,
	,,	45	007455	,,
	7·81 %	15	011179	,,
	,,	25	009046	,,
	,,	45	006143	,,
	Normal	25	010914	,,
Calcium nitrate, . . .	40·13 %	15	043779	,,
	,,	25	039177	,,
	,,	45	023116	,,

TABLE LXXII. (2)—*continued.*

Substance in Solution.	Concentration.	$t°$ C.	η	Authority.
Calcium nitrate, . . .	30·10 %	15°	0·026004	Wagner*
	„	25	020337	„
	„	45	013561	„
	17·55 %	15	016920	„
	„	25	013460	„
	„	45	010006	„
	Normal	20	014131	Mützel*
	„	25	010868	Wagner*
Cobalt nitrate, . . .	24·528 %	15	019922	„
	„	25	015884	„
	„	45	010658	„
	15·960 %	15	015692	„
	„	25	012489	„
	„	45	008111	„
	8·280 %	15	013473	„
	„	25	010457	„
	„	45	007189	„
	Normal	25	011552	„
Copper nitrate, . . .	46·71 %	15	069093	„
	„	25	051219	„
	„	45	031082	„
	26·68 %	15	022775	„
	„	25	017834	„
	„	45	012372	„
	18·99 %	15	017555	„
	„	25	013722	„
	„	45	009255	„
	Normal	25	011686	„
Lead nitrate, . . .	32·22 %	15	016575	„
	„	25	013081	„
	„	45	009124	„
	17·93 %	15	013361	„
	„	25	010670	„
	„	45	007278	„
	Normal	25	010572	„
Magnesium nitrate, . .	39·77 %	15	057215	„
	„	25	045123	„
	„	45	028535	„
	34·19 %	15	038495	„
	„	25	029667	„
	„	45	019832	„
	18·62 %	15	018008	„
	„	25	014669	„
	„	45	010147	„
	Normal	20	014769	Mützel*
	„	25	011188	Wagner*
Manganese nitrate, . .	49·309 %	15	071614	„

TABLE LXXII. (2)—*continued.*

Substance in Solution.	Concentration.	t° C.	η	Authority.
Manganese nitrate, . .	49·309 %	25°	0·054335	Wagner*
	„	45	034070	„
	29·602 %	15	030226	„
	„	25	022737	„
	„	45	015997	„
	18·309 %	15	017317	„
	„	25	013783	„
	„	45	010033	„
	Normal	25	011509	„
Nickel nitrate, . . .	40·953 %	15	040169	„
	„	25	030623	„
	„	45	019543	„
	30·006 %	15	024470	„
	„	25	019110	„
	„	45	012756	„
	16·493 %	15	016371	„
	„	25	012655	„
	„	45	008819	„
	Normal	25	011694	„
Strontium nitrate, . . .	32·61 %	15	021095	„
	„	25	016842	„
	„	45	011248	„
	21·19 %	15	015754	„
	„	25	012484	„
	„	45	008676	„
	10·29 %	15	012515	„
	„	25	010102	„
	„	45	007052	„
	Normal	20	013190	Mützel*
	„	25	011050	Wagner*
Zinc nitrate, ...	44·500 %	15	030299	„
	„	25	023568	„
	„	45	015864	„
	30·626 %	15	018897	„
	„	25	015469	„
	„	45	010410	„
	15·955 %	15	014568	„
	„	25	011600	„
	„	45	007897	„
	Normal	25	011537	„
Ammonium sulphate, . .	25·51 %	10	026780	Sprung*
	„	30	013498	„
	„	50	009763	„
	15·94 %	10	021691	„
	„	30	010899	„
	„	50	007796	„
	8·1 %	10	019471	„

TABLE LXXII. (2)—*continued.*

Substance in Solution.	Concentration.	$t°$ C.	η	Authority.
Ammonium sulphate, . .	8·1 %	30°	0·009438	Sprung*
	,,	50	006677	,,
Lithium sulphate, . . .	Normal	17·6	014749	Arrhenius*
	,,	17·6	014527	Kreichgauer*
	,,	25	012202	Wagner*
Potassium sulphate, . .	9·769 %	10	014617	Sprung*
	,,	30	009384	,,
	,,	50	006659	,,
	5·173 %	10	013967	,,
	,,	30	008770	,,
	,,	50	006190	,,
	13·80 %	17–18	0133	O. E. Meyer
	8·865 %	,,	0123	,,
	4·43 %	,,	0124	,,
	Normal	17·6	012616	Arrhenius*
	,,	17·6	012490	Kreichgauer*
	,,	25	010550	Wagner*
Sodium sulphate, . . .	12·71 %	30	012632	Sprung*
	,,	50	008680	,,
	6·626 %	10	016042	,,
	,,	30	010069	,,
	,,	50	007020	,,
	3·352 %	10	014509	,,
	,,	30	009023	,,
	10·425 %	0	0296	O. E. Meyer
	7·780 %	0	0253	,,
	5·160 %	0	0230	,,
	2·567 %	0	0205	,,
	Normal	17·6	012228	Arrhenius*
	,,	17·6	012228	Kreichgauer*
	,,	25	011845	Wagner*
Beryllium sulphate, . .	Normal	25	0123879	Wagner
Cadmium sulphate, . .	22·011 %	15	021801	Wagner*
	,,	25	016575	,,
	,,	45	010851	,,
	14·660 %	15	017354	,,
	,,	25	013058	,,
	,,	45	008803	,,
	7·140 %	15	014238	,,
	,,	25	011154	,,
	,,	45	007455	,,
	Normal	25	012375	,,
Cobalt sulphate, . . .	21·167 %	15	034936	,,
	,,	25	026383	,,
	,,	45	016232	,,
	14·156 %	15	021259	,,
	,,	25	017235	,,

TABLE LXXH. (2)—*continued.*

Substance in Solution.	Concentration.	$t°$ C.	η	Authority.
Cobalt sulphate, . . .	14·156 %	45°	0·011127	Wagner*
	7·239 %	15	015649	,,
	,,	25	012401	,,
	,,	45	008135	,,
	Normal	25	012436	,,
Copper sulphate, . . .	17·49 %	15	022470	,,
	,,	25	017477	,,
	,,	45	011152	,,
	12·57 %	15	017897	,,
	,,	25	013350	,,
	,,	45	009384	,,
	6·79 %	15	014370	,,
	,,	25	011154	,,
	,,	45	007471	,,
	Normal	17·6	016123	Arrhenius*
	,,	25	013211	Wagner*
Magnesium sulphate, . .	19·325 %	10	054534	Sprung*
	,,	30	030028	,,
	,,	50	019128	,,
	14·031 %	10	033908	,,
	,,	30	019381	,,
	,,	50	012830	,,
	9·497 %	10	023622	,,
	,,	30	014021	,,
	,,	50	009564	,,
	4·984 %	10	017360	,,
	,,	30	010647	,,
	,,	50	007381	,,
	Normal	17·6	015988	Arrhenius*
	,,	17·6	015882	Kreichgauer*
	,,	25	012313	Wagner*
Manganese sulphate, . .	22·08 %	15	119426	,,
	,,	25	085590	,,
	,,	45	048146	,,
	18·80 %	15	041258	,,
	,,	25	031076	,,
	,,	45	019385	,,
	11·45 %	15	023355	,,
	,,	25	017790	,,
	,,	45	011439	,,
	Normal	25	013354	,,
Nickel sulphate, . . .	25·35 %	15	053875	,,
	,,	25	040590	,,
	,,	45	027507	,,
	18·19 %	15	028958	,,
	,,	25	021638	,,
	,,	45	013660	,,

TABLE LXX II. (2)—*continued.*

Solution.	Concentration.	$t°$ C.	η	Authority.
. . .	10·62 %	15°	0·017077	Wagner*
	"	25	013256	"
	"	45	008983	"
	Normal	25	013369	"
. . .	23·09 %	15	042014	"
	"	25	032015	"
	"	45	019509	"
	16·64 %	15	028156	"
	"	25	021404	"
	"	45	013256	"
	7·12 %	15	017515	"
	"	25	014303	"
	"	45	009299	"
	Normal	17·6	016201	Arrhenius*
	"	17·6	016058	Kreichgauer*
	"	25	014550	Wagner*
ıate, . .	"	25	013554	O. E. Meyer
. . .	3·52 %	10·4	0164	"
	"	12·5	0150	"
	"	22·3	0120	"
ımate, . .	28·04 %	10	018058	Slotte*
	"	30	014442	"
	"	40	009927	"
	19·75 %	10	015808	"
	"	30	012578	"
	"	40	008788	"
	10·52 %	10	014267	"
	"	30	011224	"
	"	40	007615	"
ıate, . .	32·78 %	10	019760	Sprung*
	"	30	016039	"
	"	40	011298	"
	24·26 %	10	017540	Slotte*
	"	30	013967	"
	"	40	009427	"
	19·61 %	10	015391	"
	"	30	012397	"
	"	40	008653	"
	11·93 %	10	013686	Sprung*
	"	30	011286	"
	"	40	007393	"
	Normal	25	010962	Wagner*
e, . . .	14·81 %	10	022918	Slotte*
	"	30	017540	"
	"	40	011242	"
	10·62 %	10	018569	"
	"	30	014267	"

TABLE LXXH. (2)—*continued.*

Substance in Solution.	Concentration.	$t°$ C.	η	Authority.
Sodium chromate, . . .	10·62 %	40°	0·009384	Slotte*
	5·76 %	10	015375	,,
	,,	30	011910	,,
	,,	40	007886	,,
Magnesium chromate, .	27·71 %	10	041848	,,
	,,	30	031038	,,
	,,	40	019255	,,
	21·86 %	10	030010	,,
	,,	30	022593	,,
	,,	40	014274	,,
	12·31 %	10	019865	,,
	,,	30	015158	,,
	,,	40	009871	,,
Ammonium dichromate, . .	19·93 %	10	013264	,,
	,,	30	010539	,,
	,,	40	007345	,,
	13·00 %	10	013047	,,
	,,	30	010268	,,
	,,	40	006911	,,
	6·85 %	10	013029	,,
	,,	30	009943	,,
	,,	40	006839	,,
Potassium dichromate, . .	6·97 %	10	013011	,,
	,,	30	009943	,,
	,,	40	013137	,,
	4·71 %	10	013029	,,
	,,	30	009925	,,
	,,	40	013119	,,

TABLE LXXII. (3)—Variation of η with Temperature, etc.

$$Z = \text{Specific viscosity of substance} = \frac{\text{Absolute viscosity} \times 100}{\text{Viscosity of water at } 0^\circ}.$$

Graetz gives the formula $\eta_t = A\frac{\Theta - t}{t - \vartheta}$ or $Z_t = A_1\frac{\Theta - t}{t - \vartheta}$

where Θ = absolute boiling point, and
ϑ = absolute solidifying point of the liquid.

TABLE LXXII. (3a).

The following are the values of the constants, taking $\eta_0 = 0{\cdot}0180456$ for water. A is the value of η midway between Θ and ϑ.

Substance.	A.	A_1.	Θ.	ϑ.
Water,	0·00132419	7·338	390°	− 28°·619
Benzol,	247406	13·71	280·6	− 78·35
Toluol,	218532	12·11	320·8	− 89·02
Acetaldehyde,	323287	17·915	182	−155·45
Acetone,	427951	23·715	235·2	−244·5
Acid, formic,	358764	19·881	301·4	− 36·72
,, acetic,	332328	18·416	321·5	− 58·19
,, propionic,	326228	18·078	339·9	− 66·46
,, butyric,	312784	17·333	363	− 44·19
,, iso-butyric,	289000	16·015	352	− 49·43
,, iso-valeric,	345898	19·168	377	− 35·51
,, iso-caproic,	395902	21·939	401	− 27·94
Allyl chloride,	479291	26·56	240·7	−268·5
i-Amyl ,,	277072	15·354	272	−104·95
i- ,, bromide,	264314	14·647	315	− 45·84
Butyl aldehyde,	227555	12·61	241	− 54·75
i-Butyl aldehyde,	302986	16·79	222	− 87·52
i- ,, chloride,	296994	16·458	238	−113·75
i- ,, bromide,	295406	16·37	287	−102·14
,, formate,	276459	15·32	288	− 82·57
i- ,, ,,	264188	14·64	278·6	− 79·44
,, acetate,	243435	13·49	305·9	− 67·04
i- ,, ,,	249210	13·81	295·8	− 76·19
i- ,, propionate,	257872	14·29	318·7	− 69·56
Carbon tetrachloride,	350987	19·45	277·9	− 70·09
Chloroform,	372642	20·65	260	−132·85
Ethyl bromide,	296850	16·45	236	−143·80

TABLE LXXH. (3*a*)—*continued.*

Substance.	A.	A_1.	Θ.	ϑ.
Ethyl formate,	0·00251556	13·94	238°·6	−114·8
" acetate,	235495	13·05	256·5	−102·4
" propionate,	248127	13·75	280·6	− 89·59
" butyrate,	237841	13·18	304·3	− 80·38
" iso-butyrate,	259857	14·40	290·4	− 88·52
" iso-valerate,	222863	12·35	316	− 65·31
Ethylene chloride,	331137	18·35	283	− 84·89
Ethylidene chloride,	436162	24·17	254·5	−147·7
Methyl acetate,	250762	13·896	239·8	−108·5
" propionate,	245781	13·62	262·7	− 96·5
" butyrate,	242533	13·44	282	− 90·96
" iso-butyrate,	295406	16·37	273·6	−113·0
" iso-valerate,	327528	18·15	296	−117·2
Propyl aldehyde,	326445	18·09	211	−127·2
" chloride,	325506	18·038	218	−164·5
i-Propyl chloride,	405918	22·494	208	−192·42
" bromide,	378777	20·99	269	−163·65
i- " "	401930	22·273	259	−171·65
" formate,	274654	15·22	267·4	−107·6
i- " "	275015	15·24	252·2	−105·45
" acetate,	262924	14·57	282·4	− 98·05
i- " "	264729	14·67	272	− 97·14
" propionate,	273932	15·18	304·8	− 81·74
i- " "	277000	15·35	292·8	− 93·39
" butyrate,	220878	12·24	326·6	− 57·17
i- " "	259676	14·39	314	− 76·13
" iso-butyrate,	270323	14·98	316	− 76·97
i- " "	249210	13·81	305	− 75·79

Graetz found his formula inapplicable to the fatty alcohols and to ethylic ether, but Thorpe and Rodger, employing more recent data, found that for the ether the values—

$$A = 0{\cdot}003338,\ \Theta = 194^\circ{\cdot}4, \text{ and } \vartheta = -227^\circ{\cdot}8$$

gave results that, on an average, differed less than 0·3 per cent. from their experimental results.

Thorpe and Rodger found that the equation first given by Slotte—

$$\eta_t = \frac{C}{(a+t)^n}$$

gave very consistent results for some seventy-two liquids. The values of the constants as determined by them are given in the following table :—

Substance.	Formula.	Range of Temperature through which Equation applies.	Values of C	Values of a	Values of n	Greatest Deviation of Calculated from Experimental Results.
Water,	H_2O	0° C. to 8° C.	58·7375	58·112	1·9944	$-0·0_43$
		0 ,, 100	5·9849	43·252	1·5423	$-0·0_44$
Bromine,	Br_2	0 ,, 57	9·6002	111·92	1·4077	$+0·0_44$
Nitrogen peroxide,	N_2O_4	0 ,, 16	28·155	140·89	1·7349	$\pm0·0_52$
Isoprene,	C_5H_8	0 ,, 30	3·3891	144·01	1·4433	$-0·0_55$
Trimethyl ethylene,	$(CH_3)_2C:CH.CH_3$	0 ,, 33	28·916	187·24	1·7855	$-0·0_52$
Pentane,	$CH_3.CH_2.CH_2.CH_2CH_3$	0 ,, 33	19·459	165·59	1·7295	$-0·0_57$
Isopentane,	$(CH_3)_2CH.CH_2.CH_3$	0 ,, 27	1·2903	118·56	1·2901	$-0·0_55$
Diallyl,	$CH_2:CH.CH_2.CH_2.CH:CH_2$	0 ,, 57	72·193	173·01	1·9340	$-0·0_56$
Hexane,	$CH_3.(CH_2)_4.CH_3$	0 ,, 64	276·01	189·42	2·1264	$+0·0_56$
Isohexane,	$(CH_3)_2CH.(CH_2)_2CH_3$	0 ,, 56	917·96	209·35	2·3237	$+0·0_57$
Heptane,	$CH_3.(CH_2)_5.CH_3$	6 ,, 93	445·97	180·14	2·1879	$+0·0_41$
Isoheptane,	$(CH_3)_2CH.(CH_2)_3.CH_3$	0 ,, 89	362·79	180·47	2·1633	$+0·0_413$
Octane,	$CH_3.(CH_2)_6.CH_3$	0 ,, 123	171·82	145·50	2·029	$+0·0_42$
Benzol,	C_6H_6	7 ,, 76	8·8415	83·92	1·5554	$+0·0_59$
Toluol,	$C_6H_5.CH_3$	0 ,, 108	18·954	112·99	1·6522	$-0·0_411$
Ethyl benzol,	$C_6H_5CH_2CH_3$	0 ,, 132	41·215	121·68	1·7616	$+0·0_46$
Xylol ortho-,	$C_6H_4(CH_3)_2$ (1:2)	0 ,, 142	19·644	96·352	1·6386	$-0·0_44$
,, meta-,	$C_6H_4(CH_3)_2$ (1:3)	0 ,, 136	19·395	115·66	1·6400	$\pm0·0_42$
,, para-,	$C_6H_4(CH_3)_2$ (1:4)	0 ,, 136	32·7453	117·730	1·7326	$\pm0·0_41$
Allyl chloride,	$CH_2:CH.CH_2Cl$	0 ,, 43	27·705	157·08	1·7459	$-0·0_54$
Propyl ,,	$CH_3CH_2.CH_2Cl$	0 ,, 45	662·52	203·36	2·2453	$-0·0_417$
Isopropyl ,,	$(CH_3)_2CHCl$	0 ,, 34	9·2541	133·60	1·5819	$-0·0_53$

Isobutyl ,,	$(CH_3)_2CH.CH_2Cl$	0 ,, 66	61·940	141·87	1·8706	$+0\cdot0_58$
Dichlormethane,	CH_2Cl_2	0 ,, 38	5·8778	128·88	1·4408	$-0\cdot0_411$
Trichlormethane (chloroform),	$CHCl_3$	0 ,, 57	70·4244	158·33	1·8196	$+0\cdot0_59$
Tetrachlormethane,	CCl_4	0 ,, 75	32·780	95·05	1·7121	$+0\cdot0_421$
Ethylene chloride,	$CH_2Cl.CH_2Cl$	0 ,, 82	24·256	100·67	1·6641	$-0\cdot0_411$
Ethylidene ,,	$CH_3.CHCl_2$	7 ,, 55	22·247	132·02	1·6762	$+0\cdot0_42$
Tetrachlorethylene,	$CCl_2 : CCl_2$	0 ,, 118	30·656	126·17	1·6325	$+0\cdot0_45$
Ethyl bromide,	$CH_3.CH_2Br$	0 ,, 37	6·8898	138·65	1·4749	$-0\cdot0_57$
Allyl ,,	$CH_2 : CH.CH_2Br$	0 ,, 69	30·360	145·03	1·7075	$-0\cdot0_59$
Propyl ,,	$CH_3.CH_2.CH_2.Br$	0 ,, 68	65·713	155·75	1·8282	$-0\cdot0_413$
Isopropyl ,,	$(CH_3)_2CHBr$	0 ,, 57	188·08	169·03	2·0166	$+0\cdot0_58$
Isobutyl ,,	$(CH_3)_2CH.CH_2Br$	0 ,, 88	472·23	161·62	2·1547	$-0\cdot0_43$
Dibromethylene,	$CHBr : CHBr$	0 ,, 106	14·868	112·29	1·5032	$+0\cdot0_43$
Ethylene bromide,	$CH_2Br.CH_2Br$	9 ,, 127	30·535	80·802	1·6222	$-0\cdot0_43$
Propylene ,,	$CH_3.CHBr.CH_2Br$	0 ,, 137	48·803	88·757	1·7075	$+0\cdot0_48$
Isobutylene ,,	$(CH_3)_2CBr.CH_2Br$	0 ,, 143	79·485	75·60	1·7988	$+0\cdot0_47$
Methyl iodide,	CH_3I	0 ,, 40	6·6577	134·32	1·4329	$-0\cdot0_54$
Ethyl ,,	$CH_3.CH_2I$	0 ,, 70	50·810	157·42	1·7520	$+0\cdot0_41$
Allyl ,,	$CH_2 : CH.CH_2I$	0 ,, 99	28·411	126·05	1·6592	$-0\cdot0_43$
Propyl ,,	$CH_3.CH_2.CH_2I$	0 ,, 100	50·893	136·84	1·7483	$+0\cdot0_42$
Isopropyl ,,	$(CH_3)_2CHI$	0 ,, 89	129·85	150·03	1·9161	$\pm0\cdot0_42$
Isobutyl ,,	$(CH_3)_2CH.CH_2I$	0 ,, 117	27·652	108·86	1·6577	$+0\cdot0_49$
Methyl alcohol,	CH_3OH	3 ,, 64	6940·8	163·93	2·6793	$+0\cdot0_44$
Ethyl ,,	CH_3CH_2OH	7 ,, 74	251908000	209·63	4 3731	$\pm0\cdot0_411$
Allyl ,,	$CH_2 : CH.CH_2OH$	7 ,, 96	10748·4	109·42	2·7925	$-0\cdot0_42$
Propyl ,,	$CH_3.CH_2.CH_2OH$	7 ,, 96	8801350	135·75	3·9188	$-0\cdot0_43$
Isopropyl ,,	$(CH_3)_2CHOH$	0 ,, 40	2175320000	141·72	4·9635	$-0\cdot0_478$
		40 ,, 78	192398	86·259	3·4079	$-0\cdot0_417$
Butyl ,,	$CH_3.CH_2.CH_2.CH_2OH$	0 ,, 52	65187500	139·05	4·2452	$-0\cdot0_424$
		52 ,, 114	117255	91·997	3·2150	$-0\cdot0_431$
Isobutyl alcohol,	$(CH_3)_2CH.CH_2OH$	0 ,, 38	1486370	92·248	3·6978	$+0\cdot0_3506$
		38 ,, 75	1112440	86·751	3·6708	$-0\cdot0_422$
		75 ,, 105	29790·3	63·14	3·0537	$+0\cdot0_54$
Trimethyl carbinol,	$(CH_3)_3COH$	20 ,, 50	205152	−7·803	1·3242	$-0\cdot0_3378$
		50 ,, 77	46·3090	+5·077	2·0143	$-0\cdot0_422$
Amyl alcohol (active),	$CH_3CH_2.CH(CH_3)CH_2OH$	0 ,, 35	66652700	101·51	4·3736	$+0\cdot0_3139$
		35 ,, 73	97413·3	64·67	3·2542	$-0\cdot0_43$
		73 ,, 124	71·8436	7·838	2·0050	$-0\cdot0_41$

TABLE LXXH. (3b)—*continued.*

Substance.	Formula.	Range of Temperature through which Equation applies.	Values of C	Values of a	Values of n	Greatest Deviation of Calculated from Experimental Results.
Amyl alcohol (inactive),	$(CH_3)_2.CH.CH_2.CH_2OH$	0° C. to 40° C.	77360200	117·79	4·3249	$-0\cdot0_3158$
		40 ,, 80	211442	79·872	3·3395	$+0\cdot0_434$
		80 ,, 128	1156·78	37·682	2·4618	$+0\cdot0_415$
Dimethyl ethyl carbinol,	$(CH_3)_2C(OH)CH_2CH_3$	0 ,, 27	35091	47·922	3·2081	$-0\cdot0_21384$
		27 ,, 63	3255·20	37·007	2·7578	$-0\cdot0_444$
		63 ,, 95	2159·86	38·340	2·6611	$+0\cdot0_418$
Ethyl ether,	$C_2H_5.O.C_2H_5$	6 ,, 32	3·8307	136·38	1·4644	$\pm0\cdot0_57$
Acetone,	$CH_3.CO.CH_3$	7 ,, 54	572·63	209·08	2·2244	$-0\cdot0_55$
Methyl ethyl ketone,	$CH_3.CH_2.CO.CH_3$	0 ,, 77	36·972	139·33	1·7895	$+0\cdot0_58$
Diethyl ketone,	$CH_3CH_2.CO.CH_2.CH_3$	0 ,, 99	64·487	146·67	1·8626	$+0\cdot0_416$
Methyl propyl ketone,	$CH_3.CH_2.CH_2.CO.CH_3$	0 ,, 99	51·543	137·75	1·8248	$+0\cdot0_417$
Acetaldehyde,	$CH_3.COH$	0 ,, 20	15652·2	286·11	2·7550	$-0\cdot0_52$
Acetic anhydride,	$(CH_3CO)_2O$	0 ,, 134	27·713	97·10	1·6851	$+0\cdot0_45$
Propionic anhydride,	$(CH_3CH_2CO)_2O$	0 ,, 165	31·312	85·011	1·7049	$+0\cdot0_45$
Formic acid,	$H.COOH$	7 ,, 98	32·8143	59·799	1·7164	$+0\cdot0_52$
Acetic acid,	CH_3COOH	30 ,, 112	267·814	112·207	2·0492	$+0\cdot0_42$
Propionic acid,	CH_3CH_2COOH	4 ,, 138	105·746	109·53	1·8840	$+0\cdot0_48$
Butyric ,,	$CH_3CH_2CH_2COOH$	3 ,, 156	195·765	94·462	1·99205	$+0\cdot0_316$
Isobutyric ,,	$(CH_3)_2CHCOOH$	3 ,, 148	212·41	104·63	2·00595	$-0\cdot0_316$
Carbon disulphide,	CS_2	0 ,, 46	24·379	199·17	1·6328	$-0\cdot0_43$
Methyl sulphide,	$(CH_3)_2S$	0 ,, 36	21·768	170·34	1·6981	$-0\cdot0_52$
Ethyl ,,	$(CH_3CH_2)_2S$	0 ,, 88	49·886	149·15	1·8175	$-0\cdot0_414$
Thiophen,	CH : CH.S.CH : CH	0 ,, 83	15·677	105·87	1·6078	$+0\cdot0_413$

TABLE LXXH. (3c).—Values of Constants in Slotte's Equation.

Slotte (*Beiblätter*, xvi. p. 182) gives the formula—

$$\eta_t = \frac{\eta_0}{(1+bt)^n}$$

and the preceding is only a modification of this.

Slotte gave first the expression—

$$\eta_t = \frac{c}{a+t} - b, \text{ i.e. } \eta_t = \frac{c-ab-bt}{a+t} = b.\frac{\left(\frac{c}{b}-a\right)-t}{a+t}$$

which is seen at once to be identical with the formula given by Graetz, when $A=b$, $\Theta=\frac{c}{b}-a$, and $\vartheta=-a$. He then found that the form $\eta_t=\eta_0\frac{1+\beta t}{(1+at)^n}$ gave better results, and this equation he finally reduced to the form at the head of this paragraph.

Thorpe and Rodger give the following values for the constants :—

Substance.	Range.	η_o	b	n
Water,	0°– 8°	0·017793	0·017208	1·9944
	0–100	017944	023121	1·5423
Bromine,	0– 57	012535	008935	1·4077
Nitrogen peroxide,	0– 16	005267	007098	1·7349
Isoprene,	0– 30	002600	006944	1·4433
Trimethyl-ethylene,	0– 33	002534	005341	1·7855
Pentane,	0– 33	002827	006039	1·7295
Isopentane,	0– 27	002724	008435	1·2901
Diallyl,	0– 57	003388	005780	1·9340
Hexane,	0– 64	003965	005279	2·1264
Isohexane,	0– 56	003713	004777	2·3237
Heptane,	6– 93	005180	005551	2·1879
Isoheptane,	0– 89	004767	005541	2·1633
Octane,	0–123	007025	006873	2·0290
Benzol,	7– 76	009055	011963	1·5554
Toluol,	0–108	007684	008850	1·6522
Ethyl benzol,	0–132	008745	008218	1·7616
Xylol, ortho-,	0–142	011029	010379	1·6386
,, meta-,	0–136	008019	008646	1·6400
,, para-,	0–136	008457	008494	1·7326
Allyl chloride,	0– 43	004059	006366	1·7459
Propyl ,,	0– 45	004349	004917	2·2453
Isopropyl ,,	0– 34	004012	007485	1·5819

TABLE LXXH. (3c)—*continued.*

Substance.	Range.	η_0	b	n
Isobutyl chloride,	0°– 66°	0·005842	0·007048	1·8706
Dichlormethane,	0– 38	005357	007759	1·4408
Trichlormethane,	0– 57	007006	006316	1·8196
Tetrachlormethane,	0– 75	013466	010521	1·7121
Ethylene chloride,	0– 82	011269	009933	1·6640
Ethylidene chloride,	7– 55	006025	007575	1·6761
Tetrachlorethylene,	0–118	01139	007925	1·6325
Ethyl bromide,	0– 37	004776	007212	1·4749
Allyl ,,	0– 69	006190	006895	1·7075
Propyl ,,	0– 68	006448	006421	1·8282
Isopropyl bromide,	0– 57	006044	005916	2·0166
Isobutyl ,,	0– 88	008234	006187	2·1547
Dibromethylene,	0–106	012307	008905	1·5032
Ethylene bromide,	9–127	024579	012375	1·6222
Propylene ,,	0–137	023005	011267	1·7075
Isobutylene bromide,	0–143	033209	013227	1·7988
Methyl iodide,	0– 40	005940	007444	1·4329
Ethyl ,,	0– 70	007190	006352	1·7520
Allyl ,,	0– 99	009296	007933	1·6592
Propyl ,,	0–100	009372	007308	1·7483
Isopropyl iodide,	0– 89	008783	006665	1·9161
Isobutyl ,,	0–117	011620	009186	1·6577
Methyl alcohol,	3– 64	008083	006100	2·6793
Ethyl ,,	7– 74	017753	004770	4·3731
Allyl ,,	7– 96	021736	009139	2·7925
Propyl ,,	7– 96	038610	007366	3·9188
Isopropyl ,,	0– 40	045588	007057	4·9635
	40– 78	048651	011593	3·4079
Butyl ,,	0– 52	051986	007194	4·2452
	52–114	056959	010869	3·2150
Isobutyl ,,	0– 38	080547	010840	3·6978
	38– 75	085365	011527	3·6708
	75–105	094725	015838	3·0537
Trimethyl carbinol,	20– 50	135060	128156	1·3242
	50– 77	1·755458	196967	2·0143
Amyl alcohol (active),	0– 35	0·111716	009851	4·3736
	35– 73	124788	015463	3·2542
	73–124	147676	127583	2·0050
,, ,, (inactive),	0– 40	085358	008488	4·3249
	40– 80	093782	012520	3·3395

TABLE LXXH. (3c)—*continued.*

Substance.	Range.	η_0	b	n
Amyl alcohol (inactive)—*continued*,	80°–128°	0·152470	0·026540	2·4618
Dimethyl-ethyl carbinol, . .	0– 27	142538	020868	3·2080
	27– 63	154021	027019	2·7578
	63– 95	131901	026082	2·6610
Ethyl ether, ...	6– 32	002864	007332	1·4644
Acetone, ...	7– 54	003949	004783	2·2244
Methyl-ethyl ketone, ...	0– 77	005383	007177	1·7895
Diethyl ketone, ...	0– 99	005949	006818	1·8626
Methyl propyl ketone, . . .	0– 99	006464	007259	1·8248
Acetaldehyde, ...	0– 20	002671	003495	2·7550
Acetic anhydride, ...	0–134	012416	010298	1·6851
Propionic anhydride, ...	0–165	016071	011763	1·7049
Formic acid, ...	7– 98	029280	016723	1·7164
Acetic ,, ...	30–112	016867	008912	2·0491
Propionic acid, ...	4–138	015199	009130	1·8840
Butyric ,, ...	3–156	022747	010586	1·9920
Isobutyric ,, ...	3–148	018872	009557	2·0059
Carbon disulphide, ...	0– 46	004294	005021	1·6328
Methyl sulphide, ...	0– 36	003538	005871	1·6981
Ethyl ,, ...	0– 88	005589	006705	1·8175
Thiophen, ...	0– 83	008708	009445	1·6078

The much older formula of Poiseuille,

$$\eta_t = \eta_0/(1 + \alpha t + \beta t^2),$$

s somewhat more cumbersome, and in many cases does not give nearly so good approxima-ions as Slotte's.

In the following table are given the values of the constants as calculated by Thorpe ınd Rodger. The ranges of temperature and the values of η_0 are to be taken as in the ·wo last tables.

TABLE LXXII. (3*d*).—**Values of α and β in Poiseuille's Equation.**

Substance.	Values of α	Values of β	Substance.	Values of α	Values of β
Water,	0·03580	$0{\cdot}0_32253$	Propylene bromide,	0·01924	$0{\cdot}0_47668$
Bromine,	01258	0_42290	Isobutylene bromide,	02379	0_312568
Nitrogen peroxide,	01231	0_43212	Methyl iodide,	01067	0_41719
Isoprene,	01002	0_41542	Ethyl iodide,	01113	0_42658
Trimethyl-ethylene,	00954	0_42000	Allyl iodide,	01316	0_43441
Pentane,	01044	0_42301	Propyl iodide,	01278	0_43493
Isopentane,	01088	0_41331	Isopropyl iodide,	01277	0_43899
Diallyl,	01118	0_43017	Isobutyl iodide,	01523	0_44600
Hexane,	01122	0_43337	Methyl alcohol,	01634	0_48371
Isohexane,	01110	0_43509	Ethyl alcohol,	02086	0_216782
Heptane,	01214	0_44004	Allyl alcohol,	02552	0_320902
Isoheptane,	01199	0_43863	Propyl alcohol,	02495	0_226818
Octane,	01394	0_44926	Isopropyl alcohol,	03503	0_34898
Benzol,	01861	0_46181	Butyl alcohol,	03054	0_235650
Toluol,	01462	0_44220	Isobutyl alcohol,	04008	0_35861
Ethyl benzol,	01448	0_44530	Trimethyl carbinol,	16971	0_235257
Xylol ortho-,	01701	0_45636	Amyl alcohol (act.),	04308	0_37159
,, meta-,	01418	0_43923	Amyl alcohol (inact.),	03671	0_35180
,, para-,	01472	0_44578	Dimethyl-ethyl carbinol,	06694	0_215423
Allyl chloride,	01111	0_42639	Ethyl ether,	01074	0_41828
Propyl chloride,	01104	0_43381	Acetone,	01064	0_43115
Isopropyl chloride,	01185	0_42580	Methyl-ethyl ketone,	01284	0_43639
Isobutyl chloride,	01318	0_44045	Diethyl ketone,	01270	0_43734
Dichlormethane,	01118	0_41866	Methyl-propyl ketone,	01325	0_43965
Trichlormethane,	01149	0_42588	Acetaldehyde,	00963	0_42953
Tetrachlormethane,	01801	0_46747	Acetic anhydride,	01735	0_46122
Ethylene chloride,	01653	0_45451	Propionic anhydride,	02005	0_48315
Ethylidene chloride,	01270	0_43252	Formic acid,	02870	0_316953
Tetrachlorethylene,	01294	0_43243	Acetic acid,	01826	0_48537
Ethyl bromide,	01064	0_41822	Propionic acid,	01720	0_46941
Allyl bromide,	01177	0_42871	Butyric acid,	02109	0_311073
Propyl bromide,	01174	0_43121	Isobutyric acid,	01917	0_49215
Isopropyl bromide,	01193	0_43588	Carbon disulphide,	00820	0_41302
Isobutyl bromide,	01333	0_44762	Methyl sulphide,	00997	0_41584
Dibrom-ethylene,	01339	0_42999	Ethyl sulphide,	01219	0_43340
Ethylene bromide,	02007	0_47018	Thiophen,	01518	0_44358

TABLE LXXH. (3*d*)—*continued*

The following values for η_0, α, and β have been obtained by various observers :—

Substance.	η_0	α	β	Range.	Authority.
Water,	0·018142	0·033727	0·0002196	0° to 45°	Poiseuille, calc. by Hagen
	01778	03368	221	0 ,, 45	,, ,, ,, v. Helmholtz
	01782	03368	221	0 ,, 45	,, ,, ,, P. & Battelli
	01775	03315	2437	0 ,, 45	,, ,, ,, O. E. Meyer
	017987	03638	523	2·2 ,, 67	Hagen
	01573	03502	0249	2·23 ,, 21·5	Grotrian, calc. by Grossmann
	01811	037097	1421	0 ,, 60	Noack
	017995	037097	1495	0 ,, 51·6	,,
Alcohol, 35·11%	05703	0422	6111	0 ,, 30	Stephan
49 ,,	06053	04053	6053	0 ,, 30	,,
70 ,,	04726	0397	4662	0 ,, 30	,,

TABLE LXXII. (3e).

Meyer finds that for a considerable number of liquids the simpler formula,

$$\eta_t = \eta_o/(1 + at),$$

l enough for all practical purposes.

ubstance.		η_o	a	Range.	Authority.
. . .		0·0183	0·0369	0° to 33°·7	O. E. Meyer
		01854	04635	42·01 „ 89·4	Rosencranz
nitrate, . .		02275	02256	0 „ 27	Pagliani and Oddone
cohol, . .		007344	012238	0 „ 11	Pagliani and Battelli
hol, . .		01843	020856	0 „ 10	„
ohol, . .		00417	033676	0 „ 13·4	„
lcohol, . .		08275	048037	0 „ 14	„
hol, . .		08922	043181	0 „ 12·5	„
s solutions of					
trate,	14·02 %	0191	0306	2·35 „ 24·1	O. E. Meyer
	26·07 „	0233	0280	3 „ 23·9	„
	36·35 „	0291	0233	12·8 „ 23·3	„
nitrate,	4·57 „	0179	0349	10·5 „ 23·5	„
	7·15 „	0169	0322	10·42 „ 23·8	„
	10·57 „	0166	0307	10·45 „ 23·2	„
	14·35 „	0155	0279	10·55 „ 21·65	„
lphate,	2·503 „	0205	0412	10·2 „ 18	„
	4·907 „	0230	0459	9·9 „ 18·1	„
	7·218 „	0253	0502	12·4 „ 18·1	„
	9·441 „	0296	0580	10·4 „ 17·9	„

the preceding equations lend themselves readily to rapid interpolations. For s we must obtain an equation of the form given as No. 5 on page 5, *ante*:—

$$U_x = U_o + x\Delta U_o + \frac{x(x-1)}{1.2}\Delta^2 U_o + \frac{x(x-1)(x-2)}{1.2.3}\Delta^3 U_o$$
$$+ \frac{x(x-1)(x-2)(x-3)}{1.2.3.4}\Delta^4 U_o + \text{ etc.},$$

ns of this we can readily interpolate terms to any extent by addition and nly.

r the compiler, from the results obtained by various investigators, finds that values give numbers agreeing very closely with the average values obtained ly:—

$$U_o = 0{\cdot}0180456$$
$$\Delta U_o = -0{\cdot}000537755634176$$
$$\Delta^2 U_o = +0{\cdot}000018241281536$$
$$\Delta^3 U_o = -0{\cdot}000000486030336$$
$$\Delta^4 U_o = +0{\cdot}000000006859776$$

TABLE LXXH. (4)—The Absolute Viscosity of Water from 0° C. to 100° C.

$t°$	η_t	$t°$	η_t	$t°$	η_t	$t°$	η_t
0°	0·0180456						
1	0175078	26°	0·0088312	51°	0·0054704	76°	0·0037968
2	0169883	27	0086276	52	0053861	77	0037425
3	0164866	28	0084319	53	0053040	78	0036889
4	0160021	29	0082436	54	0052240	79	0036363
5	0155344	30	0080626	55	0051459	80	0035846
6	0150831	31	0078885	56	0050696	81	0035339
7	0146476	32	0077211	57	0049950	82	0034842
8	0142276	33	0075600	58	0049221	83	0034357
9	0138225	34	0074050	59	0048506	84	0033826
10	0134320	35	0072558	60	0047804	85	0033421
11	0130556	36	0071122	61	0047116	86	0032973
12	0126929	37	0069737	62	0046440	87	0032538
13	0123435	38	0068407	63	0045776	88	0032119
14	0120069	39	0067123	64	0045122	89	0031717
15	0116828	40	0065885	65	0044479	90	0031331
16	0113708	41	0064691	66	0043845	91	0030964
17	0110704	42	0063538	67	0043220	92	0030617
18	0107813	43	0062424	68	0042605	93	0030290
19	0105031	44	0061348	69	0041997	94	0029987
20	0102355	45	0060308	70	0041398	95	0029707
21	0099780	46	0059300	71	0040807	96	0029452
22	0097304	47	0058325	72	0040223	97	0029224
23	0094922	48	0057379	73	0039648	98	0029025
24	0092632	49	0056461	74	0039080	99	0028856
25	0090430	50	0055570	75	0038520	100	0028720

TABLE LXXII. (5)—**The Absolute Viscosity of Alcohol from 0° to 72° C.**

For alcohol we get :—

$$U_o = 0{\cdot}018430$$
$$\Delta\ U_o = -0{\cdot}00037131398982$$
$$\Delta^2 U_o = +0{\cdot}00000839455679$$
$$\Delta^3 U_o = -0{\cdot}00000017311571$$
$$\Delta^4 U_o = +0{\cdot}00000000220143$$

$t°$	η_t	$t°$	η_t	$t°$	η_t	$t°$	η_t
0°	0·018430						
1	018059	19°	0·012651	37°	0·009082	55°	0·006683
2	017696	20	012412	38	008924	56	006574
3	017341	21	012178	39	008768	57	006467
4	016994	22	011950	40	008616	58	006362
5	016557	23	011727	41	008467	59	006260
6	016325	24	011508	42	008322	60	006159
7	016001	25	011295	43	008179	61	006060
8	015685	26	011087	44	008040	62	005963
9	015376	27	010883	45	007903	63	005869
10	015074	28	010684	46	007769	64	005775
11	014779	29	010490	47	007638	65	005684
12	014491	30	010300	48	007510	66	005594
13	014210	31	010114	49	007385	67	005507
14	013935	32	009932	50	007262	68	005420
15	013666	33	009755	51	007141	69	005336
16	013403	34	009581	52	007023	70	005253
17	013147	35	009411	53	006907	71	005172
18	012896	36	009245	54	006794	72	005092

TABLE LXXH. (6)—**The Absolute Viscosity of Bromine.** (L. Kann.)

t° C.	η	t° C.	η
0°	0·014268	30°	0·010874
5	013584	35	010469
10	012995	40	010114
15	012363	45	009793
20	011829	50	009489
25	011327		

TABLE LXXH. (7)—**Specific Viscosities.** Water at 0° C = 100.

Water.	Poiseuille, given by Graetz.	Poiseuille, calc. by J. C.-E.	Graham I.	Graham II.	Rellstab.	Sprung, given by Graetz.	Sprung, calc. by J. C.-E.	Slotte, given by Graetz.	Slotte, calc. by J. C.-E.	Wagner.	Landolt and Börnstein.	Thorpe and Rodger, calc. by J. C.-E.
0°	100	100	100	100	100	100	100	100	100	100	100	100
5		85·30					84·93		84·29		84·6	84·90
10	73·5	73·70	73·57	72·93	73·5	73·18	73·17		72·68		73·3	73·26
25		64·53					63·84		63·27		63·6	63·75
10	56·7	56·76	55·95	56·04	55·5	56·23	56·41	56·43	55·75	56·2	56·2	56·33
25		50·51					50·39		49·56		49·9	50·11
30	45·2	45·21	44·70	45·01	45·0	45·14	45·11	45·25	44·41	44·6	44·9	44·85
35		40·60					40·66		40·04		40·7	40·49
40	37·0	37·77	36·84	36·95	37·2	37·08	36·95	36·93	36·34	36·7	36·7	36·75
45		33·50					33·86		33·30		33·9	33·57
50	30·8		31·07	31·00	31·2	31·245	31·10		30·59	31·7	31·5	30·79
55							30·93		28·21		29·0	28·43
60			27·14	26·89		26·76			26·11		26·9	26·32
65									24·23		25·0	24·49
70									22·57		23·5	22·83
75									21·13			21·34
80									19·80			20·02
85									18·64			18·84
90									17·59			17·74
95									16·65			16·79
100									15·76			15·92

TABLE LXXII.

	0°	5°	10°	15°	20°	25°	30°	35°	40°	45°
omine,	70·73		62·37		55·88		50·53		45·95	
rbon disulphide,					20·5	19·7	19·0			
	24·16		22·27		20·64		19·24		17·94	
trogen peroxide,	29·67		26·32		23·51					
ntane,	15·92		14·37		13·05		11·92			
pentane,	15·35		13·36		12·54		11·47			
xane,	22·30		19·97		18·00		16·31		14·85	
hexane,	20·87		18·70		16·87		15·33		13·89	
ptane,	29·19		25·87		23·09		20·75		18·78	
heptane,	26·83		23·79		21·32		19·21		17·38	
tane,	39·54		34·45		30·26		26·91		24·07	
prene,	14·62		13·27		12·12		11·14			
allyl,	19·07		17·07		15·41		14·00		12·77	
soamylene,	14·29		12·99		11·89		10·91			
nzol,		45·9	42·4	39·3	36·5	33·6	31·5	29·6	27·8	25·9
			41·2		35·7		31·0		27·2	
	50·76		42·69		36·50		31·61		27·67	
luol,		41·4	38·2	35·4	33·1	31·1	29·3	27·6	26·2	25·0
			38·3				32·4			
	43·22		37·54		32·96		29·25		26·21	
hyl benzol,	49·16		42·63		37·49		33·29		29·75	
lol, ortho-,	62·01		52·53		45·39		39·68		35·04	
„ meta-,		45·6	42·4	39·3	36·9	34·7	32·7	30·8	29·1	27·7
			42·4				30·8			
	45·11		39·23		34·59		30·76		27·62	
„ para-,	Solid		41·34		36·19		32·03		28·60	
ethyl alcohol,			39	37	35·2	33·5	31·7		27·8	
			40·3		34·4		29·9		26·2	
					33·3		29·7		25·4	
	45·73		38·58		33·24		28·96		25·34	
hyl alcohol,			83·3				55·7			
			82·3				56·2			
			86·2				58·8			
	101·6	91·2	82·2	75·4	68·9	62·4	56·5	51·4	47·1	43·1
	99·55		81·50		67·04		55·65		46·54	
opyl alcohol,			111·8	103·3	94·0	85·6	76·8		62·6	
				149	131	115	100		79	
			175	156	137	121	105		83	
					127·9		99·9		78·8	
			162·2		125·7		99·0		78·3	
	218·33		164·06		126·83		99·97		78 91	
opropyl alcohol,			170	148	128	112	98		74	
					139·7		103·2		78·4	
			187·0		137·1		102·1		77·6	
	257·69		182·5		133·24		98·71		74·75	

(7) **Specific Viscosities**—*continued.*

50°	60°	70°	80°	90°	100°	110°	120°	130°	140°	150°	160°	
41·96												Th. and R.
												Wij.
												Th. and R.
												”
												”
												”
13·56	12·43											”
12·68	11·70											”
17·04	15·52	14·23	13·05	12·04								”
15·83	14·45	13·21	12·15	11·25								”
21·68	19·66	17·88	16·34	14·96	13·75	12·68	11·67					”
												”
11·67												”
												”
24·4	21·6											P. and H.
23·9												Wij.
24 58	21·96	19·74	18·39									Th. and R.
23·8	21·4											P. and H.
												de H.
23·59	21·43	19·54	17·88	16·39	15·16	14·06						Th. and R.
26·83	24·30	22·16	20·25	18·59	17·12	15·83	14·74	13·69				”
31·24	28·09	25·45	23·12	21·15	19·43	17·88	16·54	15·35	14·29			”
26·4	23·9											P. and H.
												de H.
25·00	22·72	20·75	19·07	17·60	16·25	15·13	14·06	13·10				Th. and R.
25·83	23·17	21·20	19·40	17·83	16·42	15·19	14·09	13·10				”
23·8												R.
22·9												G.
22·3												Tr.
22·27	19·66											Th. and R.
39·5												Gr. I.
39·6												Gr. II.
40·7												R.
39·5	33·9	28·7										L. and B.
39·23	33·27	28·37										Th. and R.
50·6												R.
63												P. and H.
68												”
64·1												Tr.
63·5												G.
63·44	51·69	42·58	35·32	29·58								Th. and R.
58												P. and H.
60·7												Tr.
59·9												G.
57·71	45·22	36·11	29·25									Th. and R.

TABLE LXXH.

	0°	5°	10°	15°	20°	25°	30°	35°	40°	45°
yl alcohol,			213·1	189·7	166·8	144·3	125·0		94·1	
			238	208	182	159	139		107	
	291·62		217·77		165·75		127·45		100·11	
utyl alcohol,			325	275	233	198	169		125	
					220·2		163·8		120·1	
			320·5		227·4		166·3		123·3	
	452·08		311·98		219·68		161·02		119·29	
methyl carbinol,	Solid		Solid		Solid		188·36		118·28	
yl alcohol (inctive),			366	309	264	225	193		143	
				271·2	243·8	215·6	188·2		133·7	
I.,	492·80		343·48		246·91		181·89		136·84	
II.,	479·86		337·46		244·15		180·31		135·77	
yl alcohol (active),	625·93		417·60		286·33		202·08		146·57	
ethyl-ethyl carinol,	797·47		442·07		261·08		168·73		114·96	
l alcohol,			116	104	92	80	72		58	
	120·58		95·78		76·55		65·52		51·24	
ylene glycol,										
pyl chloride,			21·5	20·6	19·6	18·6	17·7	16·7	15·7	
	24·52		21·93		19·80		17·94		16·37	
ropyl chloride,			22	21	20	19	18			
	22·61		20·13		18·11		16·39			
utyl chloride,			30	28	26·5	25	23·5		21	
	32·82		28·91		25·67		22·95		20·61	
myl chloride,			35	32·5	30	29	27·5		25	
l chloride,	22·83		20·50		18·53		16·76		15·38	
ochlor-benzol,			53·1	49·7	46·5	43·8	41·2	38·8	36·9	35·0
ochlor-toluol,			62·8	58·5	54·6	50·7	47·5	44·9	41·9	39·3
zyl chloride,				84·7	77·4	70·6	65·5	60 8	56·8	53·2
hylene dichloride,	30·15		27·02		24·49		22·30		20·42	
ylene chloride,				49·8	46·5	43·5	40·5	37·7	35·6	33·6
	63·44		54·05		46·85		41·06		36·03	
ylidene chloride,			32	30·5	29	27·5	26		24	
	34·95		30·88		27·56		24·77		22·41	
roform,			36	34	32	30·5	29		26	
					31·4	29·8	28·4		25·8	
	39·37		35·21		31 72		28·74		26·18	
bon tetrachloride,			65	60	56	52	48		42	
	75·73		63·72		54·50		47·33		41·51	
achlor-ethylene,	64·07		56·44		50·20		45·16		40·86	
yl bromide,			24	22·5	21	20	19·5			
	26·88		24·27		22·05		20·8			
pyl bromide,			31·3	30·0	28·7	27·5	26·2	24·9	23·6	22·3
	36·28		32·34		29·08		26·26		23·90	

(7)—*continued*.

50°	60°	70°	80°	90°	100°	110°	120°	130°	140°	150°	160°	
78·0												R.
84												P. and H.
79·25	63·92	52·11	42·86	35·63	30·06	25·56						Th. and R.
94												P. and H.
91·4												Tr.
94·2												G.
90·49	69·68	54·72	43·81	35·60	29·30							Th. and R.
80·74	57·90	43·42	33·72									”
110												P. and H.
103·5												R.
104·72	81·50	64·65	51·97	42·58	35·21	29·61	25·17	21·57				Th. and R.
103·99	81·16	64·51	51 94	42·60	35·29	29·75	25·34	21·71				”
107·86	82 79	64·51	51·12	41·34	34·03	28·40	24·13					”
81 95	60·60	46·68	36·98	29·81	24·41							”
47												P. and H.
42·72	36·11	30·79	26·43	22·89								Th. and R.
	350 @ 55°·8											P. and H.
												”
												Th. and R.
												P. and H.
												Th. and R.
19												P. and H.
18·67	16·96											Th. and R.
22												P. and H.
												”
33·2												”
37·1	32·7											”
49·5	43·5	40·2										”
												Th. and R.
31·7												P. and H.
32·42	29·19	26·43	23·95									Th. and R.
22												P. and H.
20·39												Th. and R.
24												P. and H.
												Wij.
23·95	21·93											Th. and R.
37												P. and H.
36·75	29·47											Th. and R.
37·18	34·03	31·30	28·91	26·71	24·80	23·09	21·51					”
												P. and H.
												Th. and R.
												P. and H.
21·79	19·99	18·42										Th. and R.

TABLE LXX

	0°	5°	10°	15°	20°	25°	30°	35°	40°	45°
propyl bromide, .			32	31	29·5	28	27		24·5	
	34·00		30·26		27·11		24.47		22·16	
butyl bromide, .	46·31		40·55		35·88		32·00		28·77	
-amyl bromide, .			80	72	65	60	55·5		46·5	
lyl bromide, . .			34	31·5	30	28·5	27		24·5	
	34·81		31·05		27·87		25·25		23·03	
nobrom-benzol, .			78	73	68	63	59		53	
etylene bromide,	69·18		60·91		53·96		48·37		43·76	
hylene bromide, .				103·4	95·2	89·0	83·5	78·4		
	136·95		114·45		96·51		82·68		71·99	
pylene bromide, .	129·33		107·42		91·06		78·40		68·36	
butylene bromide,	186·50		149·21		121·99		102·25		86·92	
thyl iodide, . .			31·5	30·5	29	28	27		24·5	
	33·44		30·15		27·39		25·08		23·00	
hyl iodide, . .			36	34	32	30	29		27	
	40·44		36·28		32·79		29·81		27·22	
pyl iodide, . .			47·2	44·8	42·4	40	37·7	35·3	32·9	30·5
	52·76		46·51		41·45		37·20		33·66	
propyl iodide, .			47	44	41	39	37		32	
	49·41		43·59		38·81		34·81		31·44	
tyl iodide, . .			58	54·5	51·5	48·5	46		41	
butyl iodide, .			55·5	51·5	48	45·5	43		38	
	65·38		56·02		48·93		43·39		38·84	
amyl iodide, . .			67	62	58	55	51		45	
yl iodide, . .			45	42·5	40·5	38·5	36·5		33	
	52·31		46·06		40·86		36·64		33·10	
ro-ethane, . .			45	42	40	38	36		32	
ro-propane, . .			55·5	52	49	46	43		38	
-nitro-propane, .			47	44	41	39	36·5		32	
pyl nitrite, . .			25	24	23	22	21		19	
ro-butane, . .			67	62·5	58	54	50		44	
-nitro-butane, .			72	67	62	58	54		47	
butyl nitrite, .			47·5	44	41	38	35·5		30·5	
ro-benzol, . .				124·3	114·0	103·8	95·3	87·4	80·7	74·1
tho-nitro-toluol, .				144·0	130·9	117·9	107·0	97·4	89·4	82·7
lorpicrin, . .			76	71	66	61	57		50	
thyl sulphide, .	19·91		18·00		16·48		15·10			
yl mercaptan, .			24	22·5	21	20	19·5			
yl sulphide, . .			27	25·5	24	23	22		20	
	31·44		27·90		25·00		22·55		20·42	
iophen, . . .	48·99		42·30		37·06		32·79		28·25	
mic acid, . .			122·5	109·7	*99·2	89·7	81·7		68·2	
					107·6				70·9	
			127·5		101·8		82·6		69·0	
	Solid		126·26		100·22		81·95		68·36	

(7)—*continued.*

50°	60°	70°	80°	90°	100°	110°	120°	130°	140°	150°	160°	
22												P. and H.
20·16												Th. and R.
26·01	23·56	21·48	19·60	17·80								”
40·5												P. and H.
23												”
21·03	19·32	17·77										Th. and R.
48												P. and H.
39·79	36·44	33·52	30·93	28·66	26·63							Th. and R.
												P. and H.
63·22	56·16	50·34	45·44	41·23	37·57	34·36	31·61	29·13				Th. and R.
60·35	53·57	47·97	43·25	39·20	35·71	32·70	30·06	27·76	25·65			”
74·86	65·41	57·65	51·12	45·73	41·14	37·23	33·86	30·93	28 40			”
												P. and H.
												Th. and R.
25												P. and H.
24·97	23·00	21·26										Th. and R.
28·1												P. and H.
30·57	27·95	25·65	23·59	21·77	20·19							Th. and R.
29												P. and H.
28·51	26·04	23·85	21·88									Th. and R.
38												P. and H.
34·5												”
34·98	31·69	28·88	26·41	24·18	22·27	20·58	19·01					Th. and R.
40												P. and H.
30												”
30·06	27·47	25·17	23·17	21·43	19·80							Th. and R.
29												P. and H.
34·5												”
28												”
17												”
39												”
44												”
26												”
69·8	60·8											”
76·5	66·1											”
45												”
												Th. and R.
												P. and H.
18												”
18·62	17·07	15·69	14·45	13·33								Th. and R.
26·32	23·85	21·68	19·68									”
57·0												R.
												Tr.
57·8												G.
58·01	49 89	43·59	38·36	34·08	30·48							Th. and R.

TABLE LXXh.

	0°	5°	10°	15°	20°	25°	30°	35°	40°	45°
cetic acid, . .			81·9	75·8	70·1	64·9	60·2		51·9	
					79·9				56·9	
			81·4	77·2	71·7	65·5	61·4		53·6	
			84	77	71	66	61		53	
	Solid		Solid		68·56		58·27		50·67	
opionic acid, . .			70·3	65·2	60·5	55·7	51·5		45·3	
			78	72	66·5	61·5	57		51	
					63·5				49·5	
	85·43		72·33		61·81		53·77		47·30	
tyric acid (fermentation), . .			110·2	101·3	92·4	83·5	77·4		66·2	
		127	114	103	94·5	86	79	72	66·5	61·6
			108·3		90·1		75·5		65·4	
	128·46		103·99		86·50		73·17		62·85	
obutyric acid, . .				82·7	76·4	70·6	65·1	60·3	56·0	52·1
	106·02		88·08		73·96		63·33		54·95	
ovaleric acid, . .			152·4	138·1	124·1	113·7	103·3		86·8	
ocaproic acid, . .			222·2	200·4	179·1	158·0	139·7		117·1	
etic anhydride, .	69·83		59·00		50·73		44·26		39·00	
opionic anhydride,	90·44		74·63		62·77		53·82		46·77	
hyl ether, . .			16·0	15·2	14·5	13·8	13·1			
			19·3	19·2	19·1	19·0	18·9			
			14·5	13·8	13·1	12·4	11·7			
	16·08		14·54		13·19		11·92			
etone, . . .			22	21·5	21·1	20·7	20·3		19·4	
			24	23	22	21	20		18	
	22·16		20·02		18·14		16·48		15·07	
ethyl-ethyl ketone, .	30·28		26·72		23·79		21·34		19·26	
ethyl ketone, .	33·46		29·53		26·18		23·59		21·34	
ethyl-propyl ketone,	36·22		31·78		28·18		25·22		22·72	
etyl aldehyde, .			20·7	20·7	20·7					
	15·02		13·69		12·46					
opyl aldehyde, .			26·5	24·5	23	21·5	20·5		18·5	
tyl aldehyde, .			45	41	37	34	31		27	
obutyl aldehyde, .			36·5	33·5	30·5	28	26		23	
leral, . . .			39·7	37·9	36·1	34·3	32·4		28·8	
ovaleral, . .			39·5	36·5	34	32	30·5		27·5	
nzaldehyde, . .			96·1	90·1	84·0	78·0	71·9		62·9	
licyl aldehyde, .			179·8	166·1	152·4	138·7	125·1		101·7	
thyl acetate, . .			26·3	25·0	23·8	22·6	21·4		18·9	
thyl propionate, .			26	24·5	23	21·5	20		18	
thyl butyrate, .			31	29	27	26	24·5		22	
			35·5	33·8	32·0	30·3	28·6		25·1	
			42·1				35·1			
thyl isobutyrate, .			35	33	31	29	27·5		25	

(7)—*continued.*

50°	60°	70°	80°	90°	100°	110°	120°	130°	140°	150°	160°	
44·9												N.*
												Tr.†
46·3												R.‡
46												P. and H.§
44·49	39·37	35·15	31·50	28·40	25·83	23·43						Th. and R.
40·9												R.
45												P. and H.
												Tr.
42·01	37·60	33·83	30·62	27·84	25·42	23·26	21·34	19·66	18·08			Th. and R.
57·6												R.
57	50	44										P. and H.
57·8												G.
54·64	48·00	42·52	37·91	34·00	30·65	27·78	25·28	23·00	21·03	19·29	17·66	Th. and R.
48·5												P. and H.
48·26	42·74	38·13	34·25	30·82	27·84	25·25	23·06	21·12	19·40	17·83		Th. and R.
71·5												R.
97·8												"
34·67	31·10	28·07	25·48	23·20	21·20	19·52	18·00	16·68				Th. and R.
41·06	36·39	32·51	29·30	26·52	24·16	22·44	20·22	18·62	17·21	15·97	14·82	"
												Wij.
												R.
												P. and H.
												Th. and R.
18·6												R.
16												P. and H.
13·81												Th. and R.
17·49	16·00	14·62	13·47									"
19·38	17·72	16·25	14·93	13·78	12·71							"
20·58	18·76	17·15	15·75	14·51	13·39							"
												R.
												Th. and R.
												P. and H.
23												"
21												"
25·1												R.
24·5												P. and H.
53·8												R.
84·2												"
16·4												"
17												"
20												"
21·7												"
30·4												de H.
23												P. and H.

TABLE LXXH

	0°	5°	10°	15°	20°	25°	30°	35°	40°	45°
thyl isovalerate, .			40·8	39·0	37·3	35·5	33·7		30·2	
thyl benzoate, .			130·3	120·3	110·2	100·2	90·1		75·2	
			131·2				86·2			
thyl salicylic acid,			192·1	174·1	156·0	137·9	119·8		96·7	
yl formate, . .			27·8	26·5	25·3	24·0	22·7		20·3	
			25·5	24·0	22·6	21·3	20·1	19	18·0	17
yl acetate, . .			29·9	28·5	27·8	26·2	25·0		22·6	
			28·8	26·7	25·0	23·6	22·2	20·9	19·9	18·8
yl propionate, .			36·5	34	32	30	28		26	
yl butyrate, . .			38·2	36·4	34·6	32·8	31·0		27·4	
			42·9	40·4	37·9	35·4	32·9	30·5	28·9	27·3
			39·6				31·7			
yl isobutyrate, .			41	38	35	33	31		27	
yl valerate, . .			48·0	45·6	43·2	40·8	38·4		33·6	
			50·2	46·7	43·4	40·2	37·2	34·5	32·2	30·2
hyl benzoate, . .			148·8	135·5	122·1	108·7	98·0		82·2	
			144·7				89·8			
opyl formate, .			33·5	31	29	27·5	26		23	
propyl formate, .			32	30	28	26·5	25		22·5	
opyl acetate, . .			37	35	33	31	29		25	
propyl acetate, .			36	34	32	30	28		24·5	
opyl propionate, .			48	44	41	38	36		32	
opropyl propionate,			42	39	37	35	33		29	
opyl butyrate, .			58	53	49	46	43		37	
opropyl butyrate, .			52	48	44	41	38·5		34·5	
ropyl isobutyrate, .			53	49	45·5	42·5	40		35	
opropyl isobutyrate,			47·5	43	40	38	36		32	
ropyl benzoate, .			206	181	158	142	126		104	
utyl formate, . .			46	42·5	39	36·5	34·5		30·5	
obutyl formate, .			44	41	38	35·5	33		29	
utyl acetate, . .			52	49	46	43	40		35	
sobutyl acetate, .			45·5	42·0	39·0	36·5	34·1	32	30·0	28·1
sobutyl propionate, .			55·5	51·5	47·5	44·5	41·5		36·5	
utyl butyrate, , .			62·5				47·3			
utyl benzoate, . .			228·4				126·1			
soamyl formate, .			51·4	48·8	46·1	43·4	40·7		35·4	
myl acetate, . .			59·4	54·7	50·0	46·3	43·0	39·7	36·4	34·2
soamyl acetate, .			89·4	81·9	74·4	68·7	63·0		52·9	
myl butyrate. . .			73·9				54·2			
myl valerate, . .			92·8				64·2			
soamyl valerate, .			94·1	85·1	77·9	71·3	65·4		55·9	
myl benzoate, . .			266·4				153·2			
llyl acetate, . .			38·3	36	34	32	30·5		27·5	
thyl mono-chlor-acetate, . . .			84·5	78	72	66	61		53	
nilin, . . .					247·0		179·4		135·5	

(7)—*continued.*

50°	60°	70°	80°	90°	100°	110°	120°	130°	140°	150°	160°	
26·7												R.
64·8												”
62·5												de H.
80·5												R.
17·7												”
16·1												P. and H.
20·3												R.
17·9	15·7											P. and H.
24												”
23·8												R.
25·7	22·5											P. and H.
26 9												de H.
25												P. and H.
29·9												R.
28·5	25·4											P. and H.
69·6												R.
66·4												de H.
21												P. and H.
20												”
22												”
22												”
29												”
26												”
33												”
30												”
31·5												”
28	23											”
88												”
27·5												”
26												”
30·5												”
26·3												”
32												”
38·9												de H.
85·7												”
31·1												R.
32·7												P. and H.
44·1												R.
43·2												de H.
49·2												”
48·4												R.
99·2												de H.
25												P. and H.
46												”
106·4												Wij.

TABLE LXXI

	0°	5°	10°	15°	20°	25°	30°	35°	40°	45°
Methyl isovalerate, .			40·8	39·0	37·3	35·5	33·7		30·2	
Methyl benzoate, .			130·3	120·3	110·2	100·2	90·1		75·2	
			131·2				86·2			
Methyl salicylic acid,			192·1	174·1	156·0	137·9	119·8		96·7	
Ethyl formate, . .			27·8	26·5	25·3	24·0	22·7		20·3	
			25·5	24·0	22·6	21·3	20·1	19	18·0	17
Ethyl acetate, . .			29·9	28·5	27·8	26·2	25·0		22·6	
			28·8	26·7	25·0	23·6	22·2	20·9	19·9	18·8
Ethyl propionate, .			36·5	34	32	30	28		26	
Ethyl butyrate, . .			38·2	36·4	34·6	32·8	31·0		27·4	
			42·9	40·4	37·9	35·4	32·9	30·5	28·9	27·3
			39·6				31·7			
Ethyl isobutyrate, .			41	38	35	33	31		27	
Ethyl valerate, . .			48·0	45·6	43·2	40·8	38·4		33·6	
			50·2	46·7	43·4	40·2	37·2	34·5	32·2	30·2
Ethyl benzoate, . .			148·8	135·5	122·1	108·7	98·0		82·2	
			144·7				89·8			
Propyl formate, .			33·5	31	29	27·5	26		23	
Isopropyl formate, .			32	30	28	26·5	25		22·5	
Propyl acetate, . .			37	35	33	31	29		25	
Isopropyl acetate, .			36	34	32	30	28		24·5	
Propyl propionate, .			48	44	41	38	36		32	
Isopropyl propionate,			42	39	37	35	33		29	
Propyl butyrate, .			58	53	49	46	43		37	
Isopropyl butyrate, .			52	48	44	41	38·5		34·5	
Propyl isobutyrate, .			53	49	45·5	42·5	40		35	
Isopropyl isobutyrate,			47·5	43	40	38	36		32	
Propyl benzoate, .			206	181	158	142	126		104	
Butyl formate, . .			46	42·5	39	36·5	34·5		30·5	
Isobutyl formate, .			44	41	38	35·5	33		29	
Butyl acetate, . .			52	49	46	43	40		35	
Isobutyl acetate, .			45·5	42·0	39·0	36·5	34·1	32	30·0	28·1
Isobutyl propionate, .			55·5	51·5	47·5	44·5	41·5		36·5	
Butyl butyrate, , .			62·5				47·3			
Butyl benzoate, . .			228·4				126·1			
Isoamyl formate, .			51·4	48·8	46·1	43·4	40·7		35·4	
Amyl acetate, . .			59·4	54·7	50·0	46·3	43·0	39·7	36·4	34·2
Isoamyl acetate, .			89·4	81·9	74·4	68·7	63·0		52·9	
Amyl butyrate. . .			73·9				54·2			
Amyl valerate, . .			92·8				64·2			
Isoamyl valerate, .			94·1	85·1	77·9	71·3	65·4		55·9	
Amyl benzoate, . .			266·4				153·2			
Allyl acetate, . .			38·3	36	34	32	30·5		27·5	
Ethyl mono-chloracetate, . . .			84·5	78	72	66	61		53	
Anilin, . . .					247·0		179·4		135·5	

(7)—*continued.*

50°	60°	70°	80°	90°	100°	110°	120°	130°	140°	150°	160°	
26·7												R.
64·8												”
62·5												de H.
80·5												R.
17·7												”
16·1												P. and H.
20·3												R.
17·9	15·7											P. and H.
24												”
23·8												R.
25·7	22·5											P. and H.
26 9												de H.
25												P. and H.
29·9												R.
28·5	25·4											P. and H.
69·6												R.
66·4												de H.
21												P. and H.
20												”
22												”
22												”
29												”
26												”
33												”
30												”
31·5												”
28	23											”
88												”
27·5												”
26												”
30·5												”
26·3												”
32												”
38·9												de H.
85·7												”
31·1												R.
32·7												P. and H.
44·1												R.
43·2												de H.
49·2												”
48·4												R.
99·2												de H.
25												P. and H.
46												”
106·4												Wij.

TABLE LXXH (8).—Absolute Viscosities of some Solutions.

(η for water at 0° = 0·0180456.)

(*a*) Inorganic acids.

Hydrogen Chloride.		Hydrogen Nitrate.			Hydrogen Sulphate.	
Grms. of Acid per 100 grms. Solution.	η at 20° C.	Grms. of Acid per 100 grms. Solution.	Values of η at 0° C.	Values of η at 10° C.	Grms. of Acid per 1 litre Solution.	η at 20°.
19·61	0·013793	53·90	0·02945	0·02324	33·7	0·010850
20·03	014088	58·10	03295	02470	59·0	011228
20·80	014293	61·56	03459	02604	114·2	012354
24·40	015176	64·30	03560	02676	228·3	015353
25·00	015293	66·60	03475	02584	458·4	023685
25·26	015646	67·82	03422	02579	748·3	040686
25·64	015647	71·24	03288	02465	922·6	062068
26·33	015766	72·85	03276	02456	1240·4	144730
28·58	016720				1839·6	221496
30·77	017764					

(*b*) Acetic acid. (Wijkander.)

Grms. of CH_3COOH in each 100 grms. Solution.	Values of η at 13° C.	20° C.	30° C.	40° C.	50° C.
2·1	0·01906	0·01640	0·01353	0·01128	0·00967
5·7	02671	02222	01752	01421	
10·8	03106	02549	01981	01575	01287
13·0	03187	02601	02009	01595	01304
15·3	03303	02682	02069	01626	01327
17·2	03330	02694	02070	01643	01324
19·6	03354	02726	02093	01635	01327
21·4	03360	02727	02079	01640	01327
23·3	03388	02739	02091	01643	01316
23·9	03322	02701	02052	01618	01314
24·4	03355	02708	02073	01623	01287
27·7	03314	02664	02038	01603	01297

TABLE LXXH. (8)—*continued.*

(*c*) Acetic Acid according to Noack's Results.

	η at 0° C.	η at 5° C.	η at 10° C.	η at 15° C.	η at 20° C.	η at 25° C.	η at 30° C.	η at 35° C.	η at 40° C.	η at 45° C.	η at 50° C.	η at 55° C.	η at 60° C.
14·82	0·024728	0·020627	0·017547	0·015156	0·013254	0·011711	0·010439	0·009373	0·008472	0·007700	0·007033	0·006454	0·005945
29·90	032154	026731	022722	019524	016972	014899	013183	011762	010557	009532	008651	007886	007492
44·85	039709	032862	027716	023736	020575	018041	015954	014219	012758	011517	010452	009530	008727
64·85	049751	040850	034270	029249	025317	022158	019581	017443	015652	014132	012829	011704	010724
69·85	050916	042373	035829	030684	026575	023240	020496	018212	016289	014656	013256	012048	010999
74·77	051440	043234	036751	031566	027375	023935	020657	018716	016711	015006	013545	012283	011188
79·32	052329	043802	037120	031807	027415	024044	021164	018765	016745	015029	013559	012294	011194
85·48	048900	041135	035051	030202	026281	023068	020404	018595	016284	014674	013289	012090	011047
89·82	044033	037679	032446	028121	024546	021561	019059	016943	015149	013613	012291	011147	010151
94·70	035361	029516	025265	021988	019387	017274	015528	014063	012816	011744	010814	010001	009337
98·52	023810	020471	017957	015995	014424	013135	012061	011151	010370	009693	009100	008576	008111
99·35	021720	019004	016858	015119	013684	012478	011452	010569	009800	009126	008529	007999	007523
99·75	017409	016044	014802	013993	012650	011720	010879	010113	009420	008786	008210	007685	007204
99·80	017256	015990	014804	013701	012681	011743	010884	010097	009379	008723	008125	007579	007080

TABLE LXXH. (8)—*continued.*

(*d*) Ethylic alcohol. (Traube.)

Percentage of Alcohol.	η at 20° C.	η at 30° C.	η at 40° C.	η at 50° C.	η at 60° C.
10	0·01564	0·01179	0·00909	0·00747	0·00622
20	02216	01574	01167	00924	00747
30	02717	01900	01383	01061	00849
40	02942	02045	01494	01152	00912
50	02912	02068	01529	01180	00918
60	02694	01970	01469	01162	00915
70	02381	01790	01366	01089	00865
80	02036	01567	01223	00981	00799
90	01643	01311	01050	00866	00714
99·6	01261	01035	00861	00729	00622

Traube found in every case that the maximum viscosity fell between 40 and 50 per cent. (inclusive); thus he found :—

Percentage of Alcohol.	η at 20° C.	η at 30° C.	η at 40° C.	η at 50° C.	η at 60° C.
44	0·02947	0·02051	0·01504	0·01157	0·00915
46	02922	02061	01509	01162	00915
48	02909	02056	01514	01177	00920

TABLE LXXH. (8)—*continued*

(*e*) Alcohol according to Noack's Results.

Percentage of Alcohol.	η at 0° C.	η at 5° C.	η at 10° C.	η at 15° C.	η at 20° C.	η at 25° C.	η at 30° C.	η at 35° C.	η at 40° C.	η at 45° C.	η at 50° C.	η at 55° C.	η at 60° C.
0	0·018054	0·015181	0·013029	0·011360	0·010028	0·008944	0·008044	0·007288	0·006644	0·006089	0·005608	0·005185	0·004813
8·21	028563	023365	019474	016510	014194	012347	010846	009610	008578	007706	006963	006324	005770
16·60	045351	035112	028082	023026	019249	016350	014071	012244	010755	009527	008498	007630	006890
25·23	064599	048638	037850	030248	024704	020542	017343	014832	012827	011201	009883	008753	007819
34·58	073206	055772	043535	034698	028217	023343	019600	016669	014337	012456	010917	009642	008576
38·98	072307	055772	043898	035211	028760	023866	020084	017115	014743	012820	011246	009932	008826
43·99	070671	055157	043764	035336	028994	024149	020383	017406	015022	013084	011492	010169	009058
49·12	066756	052715	042265	034412	028205	023855	020239	017364	015042	013148	011582	010274	009174
53·36	063211	050176	040469	033158	027586	023245	019622	017079	014857	013031	011517	010248	009174
64·64	051073	042533	035537	029851	025265	021561	018553	016095	014067	012381	010969	009777	008763
75·75	040733	034378	029206	024975	021519	018674	016324	014368	012726	011337	010157	009144	008272
87·45	029403	025562	022287	019508	017159	015168	013474	012026	010786	009736	008792	007987	007283
99·72	018018	016337	014865	013408	012160	011044	010048	009162	008374	007672	007046	006487	005986

TABLE LXXH. (8)—*continued.*

(*f*) Sugar Solutions, according to Burkhardt's Results.

Percentage of Sugar.	η at 20° C.	Percentage of Sugar.	η at 20° C.	Percentage of Sugar.	η at 20° C.	Percentage of Sugar.	η at 20° C.
1	0·010486	9	0·013248	17	0·017205	25	0·024050
2	010769	10	013625	18	017896	26	025118
3	011051	11	014003	19	018587	27	026374
4	011365	12	014442	20	019340	28	027692
5	011748	13	014945	21	020157	29	029325
6	012119	14	015447	22	021036	30	031396
7	012495	15	016012	23	021978		
8	012872	16	016577	24	022983		

TABLE LXXI.—Viscosity and Chemical Structure.

(1) In their monumental memoir Messrs Thorpe and Rodger strove to show the connection between the chemical structure and the viscosity of liquids. The following constants were calculated by them for the various elements, etc. :—

Putting $\eta d^2 = \eta \times$ specific molecular area (in sq. cms.) = molecular viscosity.
$\eta d^3 = \eta \times$ specific molecular volume (in c.cms.) = molecular viscosity work.

	At Boiling Point.		When $d\eta/dt =$ 0·0000323.		When $d\eta/dt =$ 0·0000987.	
	ηd^2	ηd^3	ηd^2	ηd^3	ηd^2	ηd^3
Hydrogen, ...	– 0·0080	0·0015	0·00445	– 0·0340	0·0086	– 0·0340
Carbon, ...	– 0·0098	+ 0·0500	0031	+ 0·1480	0060	+ 0·2780
Oxygen (hydroxyl), . .	+ 0·0196	1020	0166	1000	0320	1880
„ (ethers), . .	0035	0270	0058	0430	0112	0730
„ (carbonyl), . .	0248	0410	0198	– 0·0190	0382	– 0·0360
Sulphur, ...	0155	0990	0246	+ 0·1440	0174	+ 0·2710
Chlorine (in mono-chlorides),	0284	1090	0256	0890	0494	1674
„ (in dichlorides), .			0244	0820	0470	1540
Bromine (in mono-bromides),	0420	1760	0372	1510	0717	2840
„ (in dibromides), .	0479	2120	0361	148	0696	2780
Iodine, ...	0520	2330	0499	2180	0962	4100
CH_2 group, . . .	0062	0470	0120	0800	0232	1500
Iso-grouping, . . .	0015	0050	0021	– 0·0080	– 0·0040	– 0·0150
Double linkage, . . .	0113	– 0·0310	0048	– 0·0950	+ 0·0092	– 0·1790
Ring formation, . . .	0610	– 0·0600	0244	– 0·3690	0465	– 0·6940

TABLE LXXI (2).—**Chemical Structure and Viscosity of Liquids at their Boiling Points.** (Thorpe and Rodger.)

Name.	Formula.	$t°$ C.	η	ηd^2	Specific Molecular Area.	ηd^3	Specific Molecular Volume.
Water,	H_2O	100·0°	0·00283	0·0199	7·05	0·053	18·73
Bromine,	Br_2	58·9	00691	0981	14·20	370	53·5
Isoprene,	C_5H_8	36·2	00185	0415	22·10	195	103·9
Trimethyl-ethylene,	C_5H_{10}	36·1	00188	0420	22·69	200	108·1
Pentane,	C_5H_{12}	36·3	00200	0480	24·00	235	117·6
Isopentane,	C_5H_{12}	30·4	00203	0489	24·10	240	118·3
Diallyl,	C_6H_{10}	59·2	00192	0483	25·15	242	126·1
Hexane,	C_6H_{14}	69·4	00204	0550	26·94	285	139·8
Isohexane,	C_6H_{14}	62·0	00205	0551	26·87	286	139·3
Heptane,	C_7H_{16}	98·4	00199	0593	29·78	323	162·5
Isoheptane,	C_7H_{16}	90·3	00198	0588	29·72	321	162·0
Octane,	C_8H_{18}	125·3	00198	0646	32·62	369	186·3
Benzol,	C_6H_6	80·2	00316	0661	20·92	302	95·7
Toluol,	C_7H_8	110·7	00248	0596	24·05	293	118·0
Ethyl-benzol,	C_8H_{10}	136·1	00233	0624	26·80	323	138·7
Ortho-xylol,	C_8H_{10}	144·0	00247	0660	26·73	341	138·2
Meta-xylol,	C_8H_{10}	139·0	00219	0590	26·92	306	139·7
Para-xylol,	C_8H_{10}	138·2	00220	0594	26·99	308	140·2
Allyl chloride,	C_3H_5Cl	45·5	00261	0504	19·29	221	84·7
Propyl chloride,	C_3H_7Cl	46·4	00274	0557	20·32	251	91·6
Isopropyl chloride,	C_3H_7Cl	36·3	00274	0567	20·66	258	93·9
Isobutyl chloride,	C_4H_9Cl	68·6	00280	0657	23·47	318	113·7
Dichlormethane,	CH_2Cl_2	40·2	00363	0587	16·18	236	65·1
Trichlormethane,	$CHCl_3$	61·3	00386	0743	19·25	326	84·5
Tetrachlormethane,	CCl_4	76·8	00488	1077	22·07	506	103·7
Ethylene chloride,	$C_2H_4Cl_2$	84·0	00410	0795	19·38	350	85·3
Ethylidene chloride,	$C_2H_4Cl_2$	57·4	00338	0674	19·93	301	89·0
Tetrachlor-ethylene,	C_2Cl_4	120·7	00380	0898	23·59	436	114·6
Ethyl bromide,	C_2H_5Br	38·4	00328	0597	18·18	255	77·5
Allyl bromide,	C_3H_5Br	70·5	00315	0635	20·16	285	90·5
Propyl bromide,	C_3H_7Br	71·0	00325	0686	21·11	315	97·0
Isopropyl bromide,	C_3H_7Br	59·7	00329	0705	21·43	326	99·1
Isobutyl bromide,	C_4H_9Br	91·9	00311	0761	24·46	376	121·0
Dibromethylene,	$C_2H_2Br_2$	109·5	00442	0895	20·25	403	91·1
Ethylene bromide,	$C_2H_4Br_2$	131·0	00514	1089	21·18	501	97·5
Propylene bromide,	$C_3H_6Br_2$	141·8	00450	1085	24·11	533	118·4
Isobutylene bromide,	$C_4H_8Br_2$	149·6	00467	1274	27·29	666	142·6

TABLE LXXI. (2)—*continued.*

Substance.	Formula.	t° C.	η	ηd^2	Specific Molecular Area.	ηd^3	Specific Molecular Volume.
Methyl iodide, . .	CH_3I	42·9	0·00399	0·0639	16·02	0·256	64·1
Ethyl iodide, . .	C_2H_5I	72·4	00371	0721	19·45	318	85·8
Allyl iodide, .	C_3H_5I	102·8	00344	0745	21·67	347	100·9
Propyl iodide, . .	C_3H_7I	102·4	00353	0795	22·51	377	106·8
Isopropyl iodide, .	C_3H_7I	89·2	00359	0816	22·73	389	108·4
Isobutyl iodide, . .	C_4H_9I	120·2	00338	0862	25·50	435	128·8
Methyl alcohol, . .	CH_3OH	65·0	00328	0401	12·20	140	42·6
Ethyl alcohol, . .	C_2H_5OH	78·4	00441	0693	15·72	275	62·3
Allyl alcohol, . .	C_3H_5OH	96·6	00373	0659	17·66	277	74·2
Propyl alcohol, . .	C_3H_7OH	97·4	00463	0869	18·77	376	81·3
Isopropyl alcohol, .	C_3H_7OH	82·9	00490	0928	18·92	404	82·3
Butyl alcohol, . .	C_4H_9OH	117·3	00405	0883	21·80	410	101·8
Isobutyl alcohol, . .	C_4H_9OH	107·8	00452	0987	21·84	461	102·1
Trimethyl carbinol, .	C_4H_9OH	82·4	00566	1243	21·96	582	102·9
Amyl alcohol (active) .	$C_5H_{11}OH$	128·7	00374	0920	24·60	456	122·0
„ (inactive)	$C_5H_{11}OH$	131·4	00378	0936	24·77	466	123·3
Dimethyl-ethyl carbinol,	$C_5H_{11}OH$	101·9	00418	1024	24·50	507	121·4
Ethyl ether, . .	$C_2H_5OC_2H_5$	34·8	00205	0459	22·41	217	106·1
Acetone, . . .	CH_3COCH_3	56·3	00232	0420	18·10	179	77·0
Methyl-ethyl ketone, .	$C_2H_5COCH_3$	80·0	00239	0504	21·07	231	96·7
Diethyl ketone, . .	$C_2H_5COC_2H_5$	102·1	00222	0533	24·02	261	117·7
Methyl-propyl ketone, .	$CH_3COC_3H_7$	102·0	00234	0565	24·13	277	118·5
Acetaldehyde, . .	CH_3COH	21·1	00219	0322	14·71	124	56·4
Acetic anhydride, .	$(CH_3CO)_2O$	139·1	00277	0635	22·93	304	109·8
Propionic anhydride, .	$(C_2H_5CO)_2O$	168·6	00247	0710	28·75	381	154·2
Formic acid, . .	$HCOOH$	101·0	00536	0639	11·93	221	41·2
Acetic acid, . .	CH_3COOH	118·1	00385	0615	15·97	246	63·8
Propionic acid, . .	C_2H_5COOH	141·0	00319	0630	19·45	274	85·8
Butyric acid, . .	C_3H_7COOH	162·1	00309	0702	22·71	334	108·2
Isobutyric acid, . .	C_3H_7COOH	154·0	00307	0700	22·80	334	108·9
Carbon disulphide, .	CS_2	46·2	00305	0478	15·68	189	62·1
Methyl sulphide, . .	CH_3SCH_3	37·5	00253	0450	17·80	190	75·1
Ethyl sulphide, . .	$C_2H_5SC\,H_5$	92·0	00234	0572	24·44	283	120·8
Thiophen, . . .	CH:CH.S.CH:CH	84·1	00336	0649	19·32	285	84·9

TABLE LXXI. (3)—**Chemical Structure and Viscosity of Liquids, when** $d\eta/dt = 0{\cdot}0000323$.

Substance.	t°C.	η	ηd^2	Specific Molecular Area.	ηl^3	Specific Molecular Volume.
Water,	° 96·8	0·00292	0·0206	7·04	0·055	18·69
Isoprene,	– 12·1	00295	0620	21·02	284	96·38
Trimethyl-ethylene,	– 20·2	00311	0665	21·38	308	98·89
Pentane,	– 5·4	00299	0687	22·97	329	110·06
Isopentane	– 4·4	00286	0663	23·20	320	111·74
Diallyl,	9·7	00304	0728	23·95	356	117·22
Hexane,	20·5	00318	0818	25·74	415	130·56
Isohexane,	16·0	00312	0799	25·62	405	129·66
Heptane,	41·1	00330	0931	28·22	495	149·92
Isoheptane,	35·7	00322	0908	28·21	482	149·83
Octane,	64·1	00336	1035	30·80	574	170·94
Benzol,	75·9	00330	0688	20·85	314	95·23
Toluol,	69·8	00354	0821	23·19	396	111·71
Ethyl-benzol,	77·9	00367	0939	25·60	475	129·53
Ortho-xylol,	91·3	00372	0954	25·64	483	129·80
Meta-xylol,	70·6	00368	0939	25·51	474	128·86
Para-xylol,	75·1	00360	0923	25·64	467	129·79
Allyl chloride,	20·3	00328	0617	18·82	268	81·64
Propyl chloride,	26·4	00330	0658	19·93	294	88·95
Isopropyl chloride,	21·4	00317	0644	20·31	290	91·51
Isobutyl chloride,	50·2	00331	0760	22·95	364	109·95
Dichlormethane,	37·1	00372	0600	16·12	241	64·70
Trichlormethane,	60·6	00388	0747	19·25	328	84 47
Tetrachlormethane,	104·9	00377	0854	22·65	406	107·77
Ethylene chloride,	93·7	00377	0737	19·55	326	86·46
Ethylidene chloride,	52·2	00355	0702	19·78	312	87·94
Tetrachlorethylene,	98·4	00446	1032	23·14	496	111·33
Ethyl bromide,	26·9	00368	0663	18·02	282	76·53
Allyl bromide,	50·8	00371	0734	19·79	327	88·03
Propyl bromide,	54·7	00372	0774	20·81	353	94·96
Isopropyl bromide,	51·6	00353	0750	21·25	346	98·01
Isobutyl bromide,	76·6	00360	0877	24·36	433	120·25
Dibrom-ethylene,	103·0	00463	0932	20·13	418	90·32
Ethylene bromide,	147·8	00455	0973	21·39	450	98·93
Propylene bromide,	144·6	00441	1068	24·23	526	119·28
Isobutylene bromide,	161·3	00426	1171	27·48	614	144·03
Methyl iodide,	42·9	00399	0638	15·98	255	63·91

TABLE LXXI. (3)—*continued.*

Substance.	t°C.	η	$\eta_t l^2$	Specific Molecular Area.	$\eta_t l^3$	Specific Molecular Volume.
Ethyl iodide, . . .	61·5	0·00404	0·0778	19·25	0·341	84·44
Allyl iodide, . . .	82·0	00406	0864	21·28	399	98·19
Propyl iodide, . . .	83·6	00407	0903	22·18	425	104·43
Isopropyl iodide, . .	79·9	00390	0878	22·52	417	106·90
Isobutyl iodide, . .	97·6	00404	1010	24·99	505	124·94
Methyl alcohol, . .	76·5	00290	0358	12·34	126	43·36
Ethyl ether, . . .	− 2·7	00295	0635	21·52	295	99·84
Acetone, ...	17·8	00329	0572	17·39	238	72·50
Methyl-ethyl ketone, .	43·7	00330	0671	20·32	302	91·61
Diethyl ketone, . .	50·5	00343	0785	22·89	376	109·49
Methyl-propyl ketone, .	56·5	00344	0796	23·13	383	111·27
Acetaldehyde, . . .	−16·8	00316	0448	14·17	169	53·36
Acetic anhydride, . .	99·8	00378	0838	22·16	394	104·29
Propionic anhydride, .	114·0	00379	1036	27·34	542	142·94
Formic acid, . . .	138·7	00373	0456	12·24	160	42·83
Acetic acid, . . .	122·9	00370	0593	16·03	237	64·16
Propionic acid, . .	116·7	00390	0742	19·02	323	82·94
Butyric acid, . . .	138·3	00379	0842	22·22	397	104·74
Isobutyric acid, . .	129·1	00378	0843	22·31	398	105·36
Carbon disulphide, . .	6·6	00407	0618	15·19	241	59·21
Methyl sulphide, . .	5·7	00335	0578	17·26	240	71·71
Ethyl sulphide, . .	45·2	00346	0812	23·47	393	113·68
Thiophen, . . .	75·9	00364	0699	19·20	305	84·10

TABLE LXXI (4).—**Chemical Structure and Viscosity of Liquids, when $d\eta/dt =$ 0·0000987.**

Substance.	t° C.	η	ηd^2	Specific Molecular Area.	ηd^3	Specific Molecular Volume.
Water,	° 46·9	0·00577	0·0398	6·90	0·105	18·14
Bromine,	24·0	00953	1317	13·82	490	51·36
Octane,	− 0·4	00703	2055	29·24	1·113	158·18
Benzol,	19·4	00654	1299	19·87	0·579	88·58
Toluol,	5·6	00710	1572	22·15	740	104·27
Ethyl-benzol,	11·4	00744	1820	24·46	900	120·97
Ortho xylol,	26·6	00737	1806	24·51	895	121·38
Meta-xylol,	6·3	00734	1794	24·43	886	120·73
Para-xylol,	10·2	00733	1796	24·51	890	121·37
Trichlormethane,	− 11·0	00799	1445	18·09	615	76·95
Tetrachlormethane,	37·4	00763	1627	21·32	751	98·43
Ethylene chloride,	27·1	00758	1401	18·49	603	79·52
Ethylidene chloride,	− 10·7	00715	1336	18·69	578	80·83
Tetrachlorethylene,	20·7	00885	1933	21·84	903	102·04
Isobutyl bromide,	5·5	00764	1755	22·97	841	110·10
Dibromethylene,	25·5	00902	1713	18·99	747	82·79
Ethylene bromide,	68·8	00906	1828	20·18	821	90·64
Propylene bromide,	65·7	00893	2043	22·88	977	109·44
Isobutylene bromide,	83·3	00875	2270	25·95	1·157	132·19
Ethyl iodide,	− 11·6	00822	1494	18·18	0·637	77·49
Allyl iodide,	10·5	00814	1642	20·17	737	90·56
Propyl iodide,	10·0	00827	1734	20·97	794	96·04
Isopropyl iodide,	6·7	00807	1714	21·24	790	97·89
Isobutyl iodide,	26·7	00801	1897	23·69	924	115·29
Methyl alcohol,	13·5	00650	0760	11·70	260	40·03
Ethyl alcohol,	58·5	00606	0933	15·41	367	60·51
Allyl alcohol,	63·1	00610	1047	17·17	434	71·17
Propyl alcohol,	86·5	00560	1041	18·59	449	80·18
Isopropyl alcohol,	82·9	00490	0930	18·98	405	82·68
Butyl alcohol,	95·6	00575	1232	21·42	570	99·12
Isobutyl alcohol,	99·6	00525	1137	21·66	529	100·81
Trimethyl carbinol,	90·9	00461	1020	22·12	480	104·04
Amyl alcohol (active),	104·7	00555	1334	24·03	654	117·80
Amyl alcohol (inactive),	105·2	00574	1386	24·15	681	118·67
Dimethyl-ethyl carbinol,	93·8	00490	1190	24·29	527	119·71
Diethyl ketone,	− 13·1	00708	1539	21·74	718	101·38
Methyl-propyl ketone,	− 6·9	00699	1535	21·99	721	103·18
Acetic anhydride,	32·7	00760	1595	20·99	731	96·15
Propionic anhydride,	46·6	00762	1976	25·93	1·006	132·04
Formic acid,	71·7	00758	0883	11·65	0·301	39·75
Acetic acid,	50·7	00784	1188	15·15	462	58·96
Propionic acid,	44·0	00801	1439	17·97	610	76·16
Butyric acid,	65·7	00796	1671	20·99	766	96·19
Isobutyric acid,	56·5	00792	1665	21·03	764	96·47
Thiophen,	12·5	00727	1328	18·27	568	78·08

TABLE LXXJ.—**Time of Flow of Unit Volume of Liquid** (Time for unit volume of water at 60° F. = 1.)
Calculated from Boverton Redwood's results.

t F.	Refined Rape Oil.	Sperm Oil.	Neatsfoot Oil.	American Mineral Oil.			Russian Mineral Oil.		
				Sp. Gr. 0·885.	Sp. Gr. 0·913.	Sp. Gr. 0·923.	Sp. Gr. 0·884.	Sp. Gr. 0·909.	Sp. Gr. 0·915.
50°	27·94		24·31	5·69	16·67	40·39		80·00	98·82
60	21·18	6·94	18·43	4·12	11·59	26·67		48·43	77·65
70	15·88	5·36	14·35	3·53	8·82	19·02		32·16	51·76
80	12·78	4·43	10·98	2·86	6·71	14·70		22·75	35·29
90	10·20	3·76	8·60	2·49	5·33	10·27		16·71	25·10
100	8·37	3·16	6·85	2·12	4·35	7·84	39·80	12·35	17·25
110	6·63	2·76	5·78	1·96	3·51	6·00	29·00	8·86	13·14
120	5·76	2·37	4·94	1·84	3·06	4·94	20·82	6·82	9·61
130	4·84	2·24	4·39	1·75	2·49	3·96	15·63	5·31	7·25
140	4·14	1·99	3·47	1·61	2·27	3·22	12·19	4·55	5·69
150	3·74	1·92	2·96	1·47	2·00	2·76	9·80	3·73	4·51
160	3·33	1·86	2·75		1·80	2·49	7·84	3·27	3·67
170	2·98	1·80	2·43			2·27	6·31	2·76	3·04
180	2·71	1·75	2·22			2·06	5·27	2·41	2·65
190	2·53	1·69	2·08			1·84	4·53	2·22	2·39
200	2·29	1·65	1·98			1·65	3·89	1·90	2·12
210	2·12	1·60	1·90			1·57	3·33		
220	1·96	1·53	1·84			1·49	3·02		
230	1·85	1·44	1·80				2·76		
240	1·78	1·40	1·75				2·53		
250	1·70	1·36	1·73				2·32		
260		1·32	1·71				2·12		
270		1·28	1·69				1·90		
280		1·25	1·63				1·82		
290		1·21	1·61				1·74		
300		1·18	1·49				1·66		
310			1·37						
320			1·32						

TABLE LXXK.—Effusion and Diffusion of Gases.

If A = area of a small aperture in envelope enclosing a mass of gas which, as a whole, is at rest;

n = average number of molecules in unit volume;

Ω = mean molecular speed;

then, number of molecules which in unit of time get to the orifice $= \frac{1}{4}nA\Omega$, and, if the envelope be thin, it is evident that the number of molecules passing through the orifice will be either equal to or directly proportional to the number that reach it; that is, directly proportional to Ω.

When any two gases are exerting the same pressure we must have—

$$\tfrac{1}{8}\pi\rho_1\Omega_1^2 = \tfrac{1}{8}\pi\rho_2\Omega_2^2,$$

and if ρ_a = density of air, and s_1 and s_2 be the specific gravities of the gases referred to air thus becomes—

$$\tfrac{1}{8}\pi\rho_a s_1\Omega_1^2 = \tfrac{1}{8}\pi\rho_a s_2\Omega_2^2,$$

$$\text{and } s_1\Omega_1^2 = s_2\Omega_2^2,$$

$$\text{so } \Omega_1 : \Omega_2 = \sqrt{s_2} : \sqrt{s_1}.$$

That is the molecular speed, and consequently the number of molecules passing through a small orifice in a thin envelope every unit of time, varies inversely as the square root of the specific gravity: and the times of efflux of equal volumes will therefore vary directly as the square roots of the specific gravities of the gases. Taking air as the standard, Graham obtained the following comparative results—

Gas.	Square Root of Specific Gravity.	Time of Efflux of Unit Volume through	
		Drawn-out Glass Tube.	Perforated Brass Plate.
Air, ...	1·	1	1·
Hydrogen, . . .	0·263	0·277 : 0·2637	0·276
Marsh gas, . . .	0·745	0·756	: 0·753
Carbon monoxide, .	0·984	0·987	
Ethylene, . . .	0·985		0·987
Nitrogen, . . .	0·986	0·984	0·984 : 0·988
Oxygen, ...	1·051	1·053 : 1·0523	1·050 : 1·056
Nitrous oxide, . .	1·237	1·199	
Carbon dioxide, . .	1·237	1·218 : 1·2483	1·197 : 1·209

Putting p for pressure per unit area exerted by a gas of the specific gravity s (air = 1) we have

$$s = 8p/\rho_a\Omega^2;$$

and thus from the rate of effusion one may calculate the specific gravity of a gas. Bunsen calculated the following values from the effusion speeds:—

Air	= 1·
Hydrogen	= 0·079
Electrolytic water-gas ($2H_2 + O_2$)	= 0·414
Oxygen	= 1·118
Carbon dioxide	= 1·535

Except in the case of hydrogen, these values agree within some 1 per cent. with those obtained by the usual methods.

The volumes which diffuse in equal times vary inversely as the square roots of the specific gravities. The following table gives Graham's results, and the values of s and $1/\sqrt{s}$ for comparison :—

Gas.	s.	$1/\sqrt{s}$.	Volumes diffused.
Air, ...	1·	1·	1·
Hydrogen, ...	0·0694	3·7959	3·83
Marsh gas, ...	0·555	1·3423	1·344
Ethylene, ...	0·972	1·0143	1·0191
Carbon monoxide, ...	0·972	1·0143	1·0149
Nitrogen, ...	0·972	1·0143	1·0143
Oxygen, ...	1·111	0·9487	0·9487
Hydrogen sulphide, ...	1·1805	0·9204	0·95
Nitrous oxide, ...	1·527	0·8092	0·82
Carbon dioxide, ...	1·527	0·8092	0·812
Sulphur dioxide, ...	2·222	0·6709	0·68

When one gas diffuses freely into another—not being separated from it by any sort of partition or diaphragm—then according to Loschmidt's observations—

$$\text{Coefficient of diffusion} \propto T^2/P \text{ very nearly,}$$

where T = absolute temperature and P = total pressure of gases $= P_1 + P_2$, the sum of the partial pressures of both.

O. E. Meyer gives the following :—

$$D = (\pi/8)(n_1\mathfrak{L}_2\Omega_2 + n_2\mathfrak{L}_1\Omega_1)/n,$$

where D = Coefficient of diffusion,

n_1, n_2 = Number of molecules of first and second gas respectively in 1 cm.^{3}

$n = n_1 + n_2$.

$\mathfrak{L}_1, \mathfrak{L}_2$ = Free paths of the two kinds of molecules in the mixture.

$$\mathfrak{L}_1 = \Omega_1/n_2\pi\sigma^2\sqrt{\Omega_1^2 + \Omega_2^2} \quad \text{and} \quad \mathfrak{L}_2 = \Omega_2/n_1\pi\sigma^2\sqrt{\Omega_1^2 + \Omega_2^2},$$

where $\sigma = \frac{1}{2}(s_1 + s_2)$; s_1 and s_2 are the radii of the spheres of action of the two kinds of molecules.

Where we have only one gas, $\Omega_1 = \Omega_2$, $s_1 = s_2$, $n_1 = n_2 = n = \lambda^{-3}$($\lambda$ = mean distance between neighbouring molecules) we have $\mathfrak{L}_1 = \mathfrak{L}_2 = L$ and so—

$$L = 1/n\pi s^2\sqrt{2} = \lambda^3/\pi s^2\sqrt{2}.$$

If we express λ in centimetres, then $n\lambda^3 = 1$ cm^3., and, putting m for the absolute mass of an individual molecule, we get—

$$nm = \rho \text{ and therefore } \lambda^3\rho = m.$$

We can approximate to the value of $\mathfrak{L}$ by means of the formula,

$$\mathfrak{L} = 3\eta/\rho U ;$$

and putting for U the value given on page 564, we get, under a pressure of 760 mms. of ice-cold mercury,

$$\mathrm{L} = 3\eta/1743{\cdot}437\,\sqrt{\rho} = \eta/581{\cdot}145575\,\sqrt{\rho}.$$

Having obtained an approximate value for L and m, we can easily get fair approximations to ς, λ, and n.

Putting Γ_1 = number of encounters into which a molecule of first gas enters in unit time,
Γ_2 = " " " " second " "
we get—

$$\mathrm{D} = (\pi/8\mathrm{N})(n_1\Omega_2^2/\Gamma_2 + n_2\Omega_1^2/\Gamma_1),$$

$$\text{where } \Gamma_1 = \pi(\varsigma_1^2 n_1\Omega_1\sqrt{2} + \sigma^2 n_2\sqrt{\Omega_1^2+\Omega_2^2}), \text{ and}$$

$$\Gamma_2 = \pi(\varsigma_2^2 n_2\Omega_2\sqrt{2} + \sigma^2 n_1\sqrt{\Omega_1^2+\Omega_2^2}\,.$$

This equation (see O. E. Meyer) can be transformed into—

$$\mathrm{D} = (\pi/8n)\{\Omega_1^2/(\mathrm{A}+\mathrm{B}_1 n_1/n_2) + \Omega_2^2/(\mathrm{A}+\mathrm{B}_2 n_2/n_1)\},$$

where A stands for $\pi\sigma^2\sqrt{\Omega_1^2+\Omega_2^2}$, B_1 for $\pi\varsigma_1^2\Omega_1\sqrt{2}$, and B_2 for $\pi\varsigma_2^2\Omega_2\sqrt{2}$.

When the two diffusing gases are, as is almost universally the case in every instance of free diffusion, at the same temperature and under the same pressure, we get $n_1 = n_2$, and the last equation becomes—

$$\mathrm{D} = (1/8n)\left\{\Omega_2^1/(\sigma^2\sqrt{\Omega_1^2+\Omega_2^2} + \varsigma_1^2\Omega_1\sqrt{2}) + \Omega_2^2/(\sigma^2\sqrt{\Omega_1^2+\Omega_2^2} + \varsigma_2^2\Omega_2\sqrt{2})\right\};$$

and if we assume that encounters between molecules of the same kind have no influence upon the rate of diffusion, this becomes—

$$\mathrm{D} = \sqrt{\Omega_1^2+\Omega_2^2}/8n\sigma^2,$$

where D depends only on the nature of the two gases, the temperature and the aggregate pressure.

Waitz gives the following equation:—

$$\mathrm{D} = \frac{\pi}{8}\Omega\sqrt{m}\left[\frac{1}{m_1\left(\frac{n_1}{n_2}\cdot\frac{1}{\mathfrak{L}_1\sqrt{m_1}} + \mathrm{B}\right)} + \frac{1}{m_2\left(\frac{n_2}{n_1}\cdot\frac{1}{\mathfrak{L}_2\sqrt{m_2}} + \mathrm{B}\right)}\right]$$

where m_1 and m_2 stand for the respective molecular weights of the two gases, and

$$\mathrm{B} = (1/4\sqrt{2})(1/\sqrt{\mathfrak{L}_1} + 1/\sqrt{\mathfrak{L}_2})^2\sqrt{(m_1+m_2)/m_1 m_2},$$

Ω and m standing for the molecular speed and molecular weight of hydrogen (or any other normal gas).

Under normal conditions as to temperature and pressure we get—

$$\mathrm{D} = (3\pi\sqrt{2}/8)(\sqrt{m_1+m_2)/m_1 m_2})\left\{\Omega\sqrt{m}/(1/\sqrt{\mathfrak{L}_1} + 1/\sqrt{\mathfrak{L}_2})^2\right\}.$$

For experimentally determining the value of D, it will be most convenient to use the equation—

$$dp/dz = \mathrm{D}.d^2p/dx^2,$$

where p denotes the partial pressure of a gas diffusing freely into another in a vertical tube, x = vertical height above lowest part of tube, and z denotes time.

TABLE LXXK$_1$.—Coefficients of Diffusion of Gases into one another.

Diffusing Gases.	D_0 (cm.^{2}/sec.).	Authority.
Hydrogen into carbon monoxide, ...	0·64223	Loschmidt
	64883	v. Obermayer
,, ,, dioxide, ...	54367	,,
	53409	,, (calc.)
	53836	,,
	55585	Loschmidt
,, oxygen, ...	72167	,,
	68100	v. Obermayer
	67667	,,
	66550	,, (calc.)
,, air, ...	63405	,,
,, nitrous oxide, . . .	53472	,,
,, sulphur dioxide, . . .	48278	Loschmidt
,, methane, ...	62544	v. Obermayer
,, ethane, ...	45933	,,
,, ethylene, ...	48275	,,
Carbon monoxide into carbon dioxide, . .	13142	,,
	14055	Loschmidt
	16000	,,
,, ,, oxygen, ...	18022	,,
	18717	v. Obermayer
,, ,, ethylene, ...	11639	,,
,, dioxide into oxygen, ...	14095	Loschmidt
	161	,, (calc.)
,, ,, air, ...	14231	,,
	13561	v. Obermayer
	13433	,, (calc.)
	13602	Waitz
,, ,, nitrous oxide, . .	09831	Loschmidt
	14761	v. Obermayer
	09166	,, (calc.)
,, ,, methane, ...	14650	,,
	15856	Loschmidt
,, ,, ethylene, ...	10062	v. Obermayer
Oxygen into nitrogen, ...	17100	,,
	17875	,, (calc.)
,, air, ...	17753	,,
	17778	,, (calc.)

TABLE LXXK$_2$.—**Diffusion Coefficients of Various Vapours into Air, Hydrogen, and Carbon Dioxide.**

Vapour of	Molecular Formula.	$t°$ C.	Value of D^t (cm.^{2}/sec.) into			Authority.
			Air.	Hydrogen.	Carbon Dioxide.	
Water, ...	H_2O	0°	0·198	0·687	0·132	Winkelmann
		49·5	2827	1·0000	1811	”
		92·4	3451	1·1794	2384	”
		8	2390			Guglielmo
		15	2456			”
		18	2475		1554	”
Carbon disulphide, .	CS_2	0	0883	0·369	0630	Winkelmann
		19·9	1015	4255	0726	”
		32·8	1120	4626	0789	”
		0	09950			Stefan
Benzol, . . .	C_6H_6	0	0751	294	0527	Winkelmann
		19·9	0877	3406	0609	”
		45	1011	3993	0715	”
Methyl alcohol, . .	CH_4O	0	1325	5001	0880	”
		25·6	1620	6015	1046	”
		49·6	1809	6738	1234	”
Ether, ...	C_2H_6O	0	0775	296	0552	”
		10·4	0835	320	0596	”
		19·9	0893	341	0636	”
		0	08270			Stefan
Ethyl alcohol, . .	C_2H_6O	0	1016	378	0685	Winkelmann
		0	0994	3806	0693	”
		40·4	1372	503	0898	”
		49·4	1413	5410	0986	”
		63·6	1490	5676	1034	”
		66·9	1475	543	1026	”
Propyl alcohol, . .	C_3H_8O	0	0803	3153	0577	”
		66·9	1237	4832	0901	”
		83·5	1379	5434	0976	”
Butyl alcohol (normal), .	$C_4H_{10}O$	0	0681	2716	0476	”
		99·05	1265	5045	0884	”
Isobutyl alcohol, . .	$C_4H_{10}O$	0	0688	2771	0483	”
		66·9	1058	4239	0741	”
		83·6	1181	4790	0833	”
Amyl alcohol (normal), .	$C_5H_{12}O$	0	0589	2351	0422	”
		99·1	1094	4362	0784	”
Amyl alcohol (fermentation), . .	$C_5H_{12}O$	0	0585	2340	0419	”
		98·8	1084	4340	0777	”
Hexyl alcohol, . .	$C_6H_{14}O$	0	0499	1998	0351	”
		99	0927	3712	0651	”
Formic acid, . .	CH_2O_2	0	1315	5131	0879	”
		65·4	2035	7873	1343	”

TABLE LXXK$_2$.—*continued.*

Vapour of	Molecular Formula.	t° C.	Value of Dt (cm.^{2}/sec.) into Air.	Hydrogen.	Carbon Dioxide.	Authority.
Formic acid, . .	CH_2O_2	84·9°	0·2244	0·8830	0·1519	Winkelmann
Acetic acid, . .	$C_2H_4O_2$	0	1061	4040	0713	”
		0	1065	4244	0717	”
		65·5	1578	6211	1048	”
		93·4	1993	8011	1356	”
		98·5	1965	7481	1321	”
Propionic acid, . .	$C_3H_6O_2$	0	0818	3261	0576	”
		0	0847	3333	0595	”
		0	0862	3297	0591	”
		92·8	1469	5856	1035	”
		98·85	1570	6182	1104	”
		98·85	1600	6116	1097	”
Methyl acetate, . .	$C_3H_6O_2$	0	0840	3277	0557	”
		20·35	1013	3928	0679	”
		46·2	1126	4531	0760	”
Ethyl formate, . .	$C_3H_6O_2$	0	0852	3357	0572	”
		20·4	0997	3868	0653	”
		46·2	1108	4383	0751	”
Butyric acid (normal), .	$C_4H_8O_2$	0	0528	2012	0372	”
		0	0680	2639	0476	”
		98·6	1263	4905	0884	”
		99·2	0981	3740	0691	”
Isobutyric acid, . .	$C_4H_8O_2$	0	0704	2713	0472	”
		98·15	1301	5015	0872	”
Methyl propionate, .	$C_4H_8O_2$	0	0745	2949	0529	”
		46·2	1026	4036	0721	”
		66·8	1146	4564	0820	”
Ethyl acetate, . .	$C_4H_8O_2$	0	0709	2727	0487	”
		46·1	0970	3729	0666	”
Propyl formate, . .	$C_4H_8O_2$	0	0714	2811	0490	”
		46·1	1010	3946	0688	”
		66·8	1065	4234	0738	”
Isovaleric acid, . .	$C_5H_{10}O_2$	0	0555	2118	0375	”
		98·05	1031	3934	0696	”
Methyl butyrate, . .	$C_5H_{10}O_2$	0	0641	2422	0439	”
		66·8	0994	3764	0673	”
		92·1	1139	4308	0809	”
Methyl isobutyrate, .	$C_5H_{10}O_2$	0	0642	2568	0450	”
		49·4	0898	3640	0630	”
		66·65	0991	3913	0696	”
Ethyl propionate, . .	$C_5H_{10}O_2$	0	0631	2373	0450	”
		66·8	0998	3811	0690	”
		90·3	1092	4019	0806	”
Ethyl butyrate, . .	$C_6H_{12}O_2$	0	0574	2239	0407	”

TABLE LXXK$_2$.—*continued.*

Vapour of	Molecular Formula.	$t°$ C.	Value of D_t (cm.^{2}/sec.) into			Authority.
			Air.	Hydrogen.	Carbon Dioxide.	
Ethyl butyrate, . .	$C_6H_{12}O_2$	° 66·65	0·0878	0·3458	0·0620	Winkelmann
		96·5	1064	4112	0756	,,
Ethyl isobutyrate, . .	$C_6H_{12}O_2$	0	0552	2237	0400	,,
		66·65	0881	3552	0633	,,
		96·1	1121	4267	0784	,,
Propyl propionate, .	$C_6H_{12}O_2$	0	0554	2121	0396	,,
		96·5	1010	3864	0721	,,
Isobutyl acetate, . .	$C_6H_{12}O_2$	0	0592	2312	0419	,,
		66·7	0857	3446	0615	,,
		97·9	1055	4155	0745	,,
Ethyl valerate, . .	$C_7H_{14}O_2$	0	0505	2050	0366	,,
		97·6	0932	3784	0676	,,
Propyl butyrate, . .	$C_7H_{14}O_2$	0	0523	2059	0364	,,
		97·9	0965	3801	0673	,,
Propyl isobutyrate, .	$C_7H_{14}O_2$	0	0539	2120	0388	,,
		97·1	0991	3897	0714	,,
Isobutyl propionate, .	$C_7H_{14}O_2$	0	0539	2120	0388	,,
		97·9	0815	3314	0589	,,
Propyl valerate, . .	$C_8H_{16}O_2$	0	0466	1891	0341	,,
		97·6	0859	3490	0629	,,
Isobutyl butyrate, .	$C_8H_{16}O_2$	0	0474	1850	0332	,,
		97·9	0876	3415	0612	,,
Isobutyl isobutyrate, .	$C_8H_{16}O_2$	0	0468	1889	0366	,,
		97·6	0863	3488	0619	,,
Amyl propionate, . .	$C_8H_{16}O_2$	0	0466	1891	0341	,,
		97·9	0815	3314	0589	,,
Isobutyl valerate, . .	$C_9H_{18}O_2$	0	0426	1724	0305	,,
		97·8	0782	3177	0568	,,
Amyl isobutyrate, . .	$C_9H_{18}O_2$	0	0423	1694	0308	,,
		97·7	0786	3182	0564	,,

LXXK$_3$.—Variation of D with Temperature.

$$D \propto (1 + at)^n$$

$$D_t = D_o(T_t / T_o)^n \cdot p/760,$$

where p is given in millimetres of ice-cold mercury. For the so-called permanent gases *n* approximates to 1·75, and for the more easily liquefiable gases to 2. For a range of temperature from about 18° C. to 62° C., v. Obermayer found the following values for n :—

Hydrogen	into	oxygen,	$n = 1·755$
,,	,,	carbon dioxide,	$n = 1·742$
Nitrogen	,,	oxygen,	$n = 1·792$
Oxygen	,,	carbon monoxide,	$n = 1·785$
Air	,,	carbon dioxide,	$n = 1·968$
Carbon dioxide	,,	nitrous oxide,	$n = 2·050$

O. E. Meyer gives—

$$\eta_t = \eta_o(1 + \alpha t)^{\frac{1}{2}}(1 + \alpha C)(1 + C/T_t),$$

where C denotes the cohesion between the molecules of the same gas, and from this he obtains—

$$D_t = D_o(1 + \alpha t)^{\frac{3}{2}}(1 + \alpha C^1)(1 + C^1/T_t),$$

where C^1 denotes the cohesion between the dissimilar molecules.

The following are the values of C for some few gases :—

Nitrogen,	C = 84
Carbon monoxide,	100
Air,	113
Oxygen,	127
Nitrous oxide,	260
Ethylene,	272
Carbon dioxide,	277

And the following are the values which have been obtained by Sutherland, from v. Obermayer's data, for C^1 :—

Hydrogen and oxygen,	$C^1 = 100$
Hydrogen and carbon dioxide,	106
Oxygen and carbon monoxide,	124
Oxygen and nitrogen,	136
Air and carbon dioxide,	250
Carbon dioxide and nitrous oxide,	380

LXXI.—Molecular Dimensions. Mean Free Path, etc.

If, in a gas of uniform density,

λ = mean distance between neighbouring molecules, or edge of elemental cube containing one molecule,
s = radius of sphere of action of molecule,
n = number of molecules in unit volume } as before,
m = molecular weight of the gas }

then $$n\lambda^3 = 1, \text{ and } \rho\lambda^3 = m.$$

Now, if we consider all the molecules of such a gas to remain at rest, and one molecule to be projected into a mass of it, the length of the path which this molecule would probably traverse without having an encounter with any other molecule would be—

$$\mathfrak{M}_1 = \lambda^3/\pi s^2, \quad . \quad . \quad . \quad . \quad (1)$$

Should all the molecules be moving with velocities equal in all directions, then—

$$\mathfrak{M} = 3\lambda^3/4\pi s^2, \quad . \quad . \quad . \quad . \quad (2)$$

With unequal distribution of velocities in accordance with Maxwell's law, then the mean free path would be—

$$\mathfrak{L}_1 = \lambda^3/\pi s^2 \sqrt{2}, \quad . \quad . \quad . \quad . \quad (3)$$

or, applying van der Waals's correction—

$$\mathfrak{L} = (\lambda^3 - \tfrac{2}{3}\pi s^3)/\sqrt{2}\pi s^2, \quad . \quad . \quad . \quad (4)$$

In investigating the value of the coefficient of friction in a gas, we arrive at the expression—

$$\eta = mU/4\pi s^2 = \rho\lambda^3 U/4\pi s^2 \tag{5}$$

and this, in accordance with equation (2), gives us—

$$\eta = \tfrac{1}{3}\rho U \mathfrak{L}, \tag{6}$$

an expression exactly analogous to that for the pressure $p = \frac{1}{3}\rho U^2$.

Under a pressure of 760 mms. of mercury at 0° C. this, as already seen, works out to

$$\eta = 581{\cdot}145575\sqrt{\rho}.\mathfrak{L}, \tag{7}$$

From equations (3) and (5) we get—

$$\eta = \rho\mathcal{L}_1 U/2\sqrt{2}, \tag{8}$$

And under the same conditions as in (7)—

$$\eta = 616{\cdot}397966\sqrt{\rho}.\mathcal{L}_1, \tag{9}$$

Equation (6) is equivalent to

$$\eta = 0{\cdot}3618006\rho\Omega\mathfrak{L}, \tag{10}$$

and (8) to

$$\eta = 0{\cdot}3837475\rho\Omega\mathcal{L}_1, \tag{11}$$

O. E. Meyer gives—

$$\eta = \kappa mn\Omega L = \kappa\rho\Omega L, \tag{12}$$

and by means of rather complex formulæ, etc., he and Conrau have arrived at the value

$$\kappa = 0{\cdot}30967, \tag{13}$$

(See O. E. Meyer's *Kinetic Theory of Gases*, English Edition.) The compiler gets a slightly lower value—about 0·309588—for κ, but the difference is quite insignificant, so we may accept

$$\eta = 0{\cdot}30967\rho\Omega L, \tag{14}$$

as a very close approximation to the truth.

For normal pressure this works out as—

$$\eta = 497{\cdot}410277\sqrt{\rho}.L, \tag{15}$$

$$L = 0{\cdot}0020104128\eta/\sqrt{\rho}, \tag{15a}$$

Since

$$p = \pi\rho\Omega^2/8,$$

we may write (14) in the following form :—

$$\eta = 8p \times (0{\cdot}30967L/\pi\Omega), \tag{16}$$

or

$$\eta = 0{\cdot}78857pL/\Omega, \tag{17}$$

From the approximate values of the free paths we get :—

from (6) and (10),

$$\mathfrak{L} = 3\eta/\rho U = 2{\cdot}76395\eta/\rho\Omega, \tag{18}$$

from (8) and (11),

$$\mathcal{L}_1 = 2\sqrt{2}\eta/\rho U = 2{\cdot}60588\eta/\rho\Omega, \tag{19}$$

Putting $\mathfrak{M}_H$ for the molecular weight of gas or vapour when $H_2 \equiv 2$,
and $\mathfrak{M}_O$,, ,, ,, $O_2 \equiv 32$,
we get at 0° C.—

$$\Omega = 239628 \cdot 1005/\sqrt{\mathfrak{M}_H} = 240367 \cdot 3117/\sqrt{\mathfrak{M}_O},$$

and therefore

$$L_0 = 0 \cdot 29992\eta/\sqrt{\mathfrak{M}_H} \text{ or very nearly } 0 \cdot 3\eta/\sqrt{\mathfrak{M}_H},$$
$$= 0 \cdot 30085\eta/\sqrt{\mathfrak{M}_O}, \qquad (19a)$$

Since ς, the radius of the sphere of action of a molecule, must be equal to the diameter of the molecular sphere, we get—

$Q \equiv$ the sum of the diametral sections of all the molecular spheres contained in a unit volume $= n \times \pi\varsigma^2/4$, ... (20)

And, taking (3) as sufficiently near the truth for all purposes, we get—

$$n\lambda^3 = n\pi\varsigma^2\sqrt{2}L = 1, \qquad (20a)$$

and consequently

$$Q = 1/4\sqrt{2}L = 0 \cdot 1767767/L, \qquad (21)$$

With equal distribution of speeds, we get, in accordance with (2)—

$$Q = 3/16\mathfrak{L}, \qquad (21a)$$
$$Q_0 = 0 \cdot 589413\sqrt{\mathfrak{M}_H}/\eta, \qquad (21b)$$

Putting

$\mathfrak{v} \equiv$ the space actually occupied by the n molecular spheres in a unit volume of gas $= \frac{1}{6}n\pi\varsigma^3$, ... (22)

and in accordance with (20a),

$$\varsigma = n\pi\varsigma^3\sqrt{2}L = 6\mathfrak{v}\sqrt{2}L = 8 \cdot 485281\mathfrak{v}L, \qquad (22a)$$

Loschmidt has called $\mathfrak{v}$ the *coefficient of condensation.* It denotes, according to our present notions, the smallest space into which it would be possible to compress the quantity of gas in a unit volume. If we compress a gas of density ρ until it condenses into a liquid of density d, we have then—

$$\rho/d = \mathfrak{v}, \qquad (23)$$

For a large number of substances d and ρ have been experimentally ascertained; for all gases and vapours we can make close approximations to ρ from the following equations:—

$$\rho = \mathfrak{M}_H \times 0 \cdot 000044932 = \mathfrak{M}_O \times 0 \cdot 0000446560625, \qquad (24)$$

and the values of ς may be calculated directly from the values of L, $\mathfrak{M}$, and d, in accordance with the following expressions:—

$$\varsigma = 0 \cdot 0003812607L\mathfrak{M}_H/d = 0 \cdot 0003789192L\mathfrak{M}_O/d.$$

The correction made in (4), *i.e.*, $2\pi\varsigma^3/3 = 4 \times \pi\varsigma^3/6 = b/n$ in Van der Waals's equation, so

$$b = 4\mathfrak{v} = 4n \times \pi\varsigma^3/6, \qquad (25)$$

and we get approximately—

$$\varsigma = bL \times (3\sqrt{2}/2), \qquad (26)$$

If the value of b has been determined for a unit pressure, the last equation becomes—

$$\varsigma = pbL \times (3\sqrt{2}/2), \qquad (26a)$$

In the expression $\eta = 0 \cdot 30967\rho L\Omega$ we have two magnitudes, η and Ω, which are independent of the pressure p, and as ρ practically varies directly as p, we have—

$$L \propto p^{-1}.$$

If we know the value of L under one pressure, we can calculate the values for all other pressures, and thus (26a) becomes available for the computation of the value of ς under all conditions. This equation (26a) gives only roughly approximate values for ς, and there are good reasons to believe that the multiplier 4 in (25) is considerably too high; indeed, the investigations of Clausius and Jager point to the value 5/2. So

$$b = 5\mathfrak{b}/2,$$

and

$$\varsigma = (24\sqrt{2}/10)b\mathrm{L} = 6\sqrt{2}\mathfrak{b}\mathrm{L}, \qquad (27)$$

$$3\sqrt{2}/2 = 2{\cdot}12132034$$

$$24\sqrt{2}/10 = 3{\cdot}39411255$$

Dorn has applied the formula of Clausius to the calculation of ς in some instances. Assuming the molecules to be spherical in shapes and perfect conductors of electricity, Clausius finds that

$$\mathrm{K} = \text{the dielectric capacity} = (1 + 2\mathfrak{v})/(1 - \mathfrak{v}),$$

and therefore

$$\mathfrak{v} = (\mathrm{K} - 1)(\mathrm{K} + 2), \qquad (27a)$$

Loschmidt's equation (22a) then becomes—

$$\varsigma = 6\sqrt{2}\mathrm{L}(\mathrm{K} - 1)/(\mathrm{K} + 2) = 8{\cdot}485281\mathrm{L}(\mathrm{K} - 1)/(\mathrm{K} + 2), \qquad (28)$$

According to Maxwell, if $\mu \equiv$ index of refraction of the gas, then—

$$\mathfrak{v} = (\mu^2 - 1)/(\mu^2 + 2), \qquad (28a)$$

and

$$\varsigma = 6\sqrt{2}\mathrm{L}(\mu^2 - 1)/(\mu^2 + 2), \qquad (28b)$$

The values calculated according to (28) and (28a) will be much lower than those calculated according to (22a), (26), and (27).

Jäger, denoting the velocity U by c, $\mathfrak{L}$ by l, and ς by σ, employs the following approximate equations:—

$$\begin{aligned} b &= (1 - \tfrac{4}{3}n\pi\sigma^3)/n\pi\sigma^2 \\ l &= 3/4n\pi\sigma^2 \\ b &= 1/\sqrt{2}n\pi\sigma^2 \\ l &= 3\eta/\rho c \\ \mathrm{Q} &= n\pi\sigma^2/4 = 3/16b \\ \sigma &= 8\mathfrak{b}l = 2bl \end{aligned}$$

We have no certain and definite knowledge of the relation between the temperature and the value of L; at most L can only vary directly as the absolute temperature, and in general L changes more slowly than T. Winkelmann employs the formula:—

$$\mathrm{L}_t = \mathrm{L}_0\sqrt{(1 + 0{\cdot}004t)(1 + \alpha t)}(1 + 0{\cdot}00164t)^2, \qquad (29)$$

For substances which are gaseous at ordinary temperatures under atmospheric pressure, $\alpha \equiv 0{\cdot}003665$ gives the best results; and for substances that are not gaseous, under such conditions $\alpha \equiv 0{\cdot}00367$.

Putting $\mathrm{I} \equiv$ mean duration of interval between two successive encounters of the same molecule, we get—

$$\mathrm{I} = \mathrm{L}/\Omega = \lambda^3/\sqrt{2}\pi\varsigma^2\Omega, \qquad (30)$$

and putting $\Gamma \equiv 1/\mathrm{I} =$ average number of encounters any one molecule takes part in in 1 sec., we get—

$$\Gamma = \sqrt{2}\pi\varsigma^2\Omega\mathrm{N} = \Omega/\mathrm{L}, \qquad (31)$$

TABLE LXXL$_1$.—**Values of L, Q, Γ, and** s **for Substances which are Gaseous at 0° C. under ordinary Atmospheric Pressure.**

Substance.	$t°$ C.	Free Path. L in cms.	Aggregate of Diametrical Sections of all the Molecules in 1 cm.^{3} Q in cm.^{2}	Number of Encounters per sec. in millions. Γ/1,000,000.	Diameter of Molecular Sphere. s in cms.	Authority.
Air, ...	0°	$0·0_4095$			$0·0_716$	Dorn
	0	071			14	Stefan
	0	082				Puluj
	0		18400			O. E. Meyer
	0				80	O. E. Meyer, calculated from Graham
	0				30	v. der Waals
	20	096	17700		10	O. E. Meyer
Ammonia, ...	0	06976	25342	8335		*
	0	07143	24747	8140		*
	0	071	24900	8160		O. E. Meyer
	20	0737	24000	8130	16	,,
Argon, ...	0	09926	17756	3838		*
	0	099		3840		O. E. Meyer
Carbon dioxide, . . .	0	0656			18	Dorn
	0	0500			17	Stefan
	0		26700		16	Ruhlman
	0	065	27500	5530	63	O. E. Meyer
	0	063	27000	5780		,,
	0	06417	27546	5629		*
	0	06581	26862	5474		*
	0	06499	27220	5558		*
	0	06273	28182	5758		*
	0	06795	26015	5314		*
	20	068	26000	5510	13*	O. E. Meyer
Carbon monoxide, . .	0	0968			19	Dorn
	0	0950			19	Stefan

	0	09274	19062	4896		*
	0	09501	18606	4779		*
	0	09246	19119	4910		*
	20	0985	18700		19	O. E. Meyer
Chlorine, ...	0	046	38800	6270	19	,,
	0	04602	38415	6157		*
	20	0474	37300	6240		O. E. Meyer
Cyanogen, ...	0	04	43900	6270	19	,,
	0	03954	44714	8405		*
	20	0419	42200	8220		O. E. Meyer
Ethylene, ...	0	0562			21	Dorn
	0	042	42500	8090		O. E. Meyer
	0	052		8670		,,
	0	05493	32183	8192		*
	0	05629	31402	7995		*
	0	05244	33699	8581		*
	20	0582	30400			O. E. Meyer
Helium, ...	0	24		4840		,,
	0	2386	7407	4869		*
Hydrogen, ...	0	1822			14	Dorn
	0	1390			14	Stefan
	0	1510				Puluj
	0	178	9940	9520		O. E. Meyer
	0	182	9900	9280	40	,,
	0	17433	10140	9720		*
	0	17814	9923	9512		*
	0	18250	9686	9285		*
	0	18557	9526	9131		*
	0	18938	9334	8947		*
	0	18451	9581	9178		*
	15	201		8430		O. E. Meyer
	20	1855	9500	9480		,,
Hydrogen chloride, . .	0	071	25100	5670	18	,,
	0	06876	25709	5796		*
	0	07031	25144	5668		*
	20	0734	24100			O. E. Meyer

TABLE LXXL$_1$.—*continued.*

Substance.	$t°$ C.	Free Path. L in cms.	Aggregate of Diametrical Sections of all the Molecules in 1 cm.^{3} Q in cm.^{2}	Number of Encounters per sec. in millions. Γ/1,000,000.	Diameter of Molecular Sphere. s in cms.	Authority.
Hydrogen sulphide, . .	0°	$0{\cdot}0_4 06$	29300	6780	$0{\cdot}0_7 22$	O. E. Meyer
	0	05951	29703	6875		*
	0	06086	29049	6722		*
	20	0628	28100			O. E. Meyer
Methane, ...	0	0833			23	Dorn
	0	0590				Stefan
	0	080	22200	7530		O. E. Meyer
	0	0782	22606	7649		*
	0	0797	22179	7505		*
	20	0848	20800			O. E. Meyer
Methyl chloride, . . .	0	044	40100	7630		,,
	0	04344	40698	7815		*
	0	04450	39729	7629		*
	20	0459	38500			O. E. Meyer
Methyl ether, . . .	0	041	43500	8650		,,
	0	04015	44028	8749		*
	0	04082	43310	8605		*
	20	0422	41800			O. E. Meyer
Nitrogen, ...	0		18000		34	Ruhlmann
	0	095		4780		O. E. Meyer
	0	094	18600	4820	17	,,
	0	0929	19028	4876		*
	0	09489	18630	4774		*
	0	09432	18741	4801		*
	0	09578	18339	4729		*
	20	0986	17900	4760		O. E. Meyer
Nitric oxide, . . .	0	094	19200	4750	16	,,
	0	09036	19563	4849		*

	0	09228	19155	4759		*
	20	0959	18400	4735		O. E. Meyer
Nitrous oxide, . . .	0	0657			18	Dorn
	0	042			19	Stefan
	0	065		5550		O. E. Meyer
	0	061	27100	5910		„
	0	04753	37196	7397		*
	0	0653	27070	5384		*
	0	06137	28815	5550		*
	20	0681	26000		12	O. E. Meyer
Oxygen, ...	0	0740				Stefan
	0	102		4180		O. E. Meyer
	0	100	17400	4280	16	„
	0	10165	17391	4180		*
	0	10484	16861	4053		*
	0	10591	16692	4012		*
	0	09968	17735	4262		*
	20	1059	16700	4065		O. E. Meyer
Sulphur dioxide, . . .	0	0468			69	Dorn
	0	0390				Stefan
	0	047	37900	6390	17	O. E. Meyer
	0	04608	38372	6424		*
	0	04702	37598	6295		*
	20	0485	36400			O. E. Meyer

TABLE LXXL$_2$.—**Values of L, Q, Γ, and ς for Substances which are Liquid at 0° C. under ordinary Atmospheric Pressure.**

In this table the substances are arranged so as to facilitate the comparison of the values for isomers, metamers, etc.

Substance.	Formula.	t° C.	L.	Q.	Γ/10⁶.	ς.	Authority.
Mercury,	Hg	370°	$0{\cdot}0_4209$		1245		O. E. Meyer
		0	0344		7540		"
		0	03437	51428	4928		Koch *
Water,	H_2O	(*b*) 100	024			$0{\cdot}0_710$	Hodges
		20	0649			09	O. E. Meyer
		0	058				Puluj
		0	0562	178000			Winkelmann
		15	071	24900	7980		O. E. Meyer
		0	0641	27570			*
Carbon disulphide,	CS_2	0	0290			$0{\cdot}0_6102$	Puluj
		0	0255	392000		09	Winkelmann
		0	0319	55444			*
Benzol,	C_6H_6	0	0220			113	Puluj
		0	0190	527000		099	Winkelmann
		0	0241				*
		0	0234	73166			*
Chloroform,	$CHCl_3$	(*b*) 61·2	00562	31500	43220		Steudel
		0		38540			"
		0	024			112	Puluj
		0	0264	66890			*
Bromoform,	$CHBr_3$	(*b*) 151·2	00597	30300	31525		Steudel
		0		43520			"
Methyl iodide,	CH_3I	(*b*) 44	00564	28070	38475		"
		0		33625			"
Ethyl chloride,	C_2H_5Cl	20	0373	47400	8042		O. E. Meyer
		0		49300		149	"
		0	0351	50430			*
		0	0356	49635			*
Ethyl bromide,	C_2H_5Br	(*b*) 38·4	00562	32350	43647		Steudel

		0		35950			”
Ethyl iodide, . . .	C_2H_5Br	(*b*) 72·3	0057	31000	37895		”
		0		39240			”
Ethylene chloride, . .	$CH_2Cl.CH_2Cl$	(*b*) 83·5	00568	31100	48450		”
		0		40650			”
Ethylidene chloride, .	CH_3CHCl_2	(*b*) 59·9	00543	32330	49040		”
		0		39730			”
Ethylene chlorobromide,	$CH_2Cl.CH_2Br$	(*b*) 104·5	00546	32400	43150		”
		0		44790			”
Ethylene bromide, . .	$CH_2Br.CH_2Br$	(*b*) 131·6	00587	30120	36320		”
		0		44640			”
Trichlorethane (α), . .	$CH_3C.Cl_3$	(*b*) 174·2	00546	32380	46758		”
		0		41190			”
Dichlorethyl chloride, .	$CHCl_2.CHCl$	(*b*) 113·6	00547	32320	45210		”
		0		45780			”
Chlorethylene bromide, .	$CH_2Br.CHClBr$	(*b*) 162·5	00568	31000			”
		0		49410			”
Propyl chloride, . .	$CH_3CH_2CH_2Cl$	(*b*) 46·4	00519	32800	56416		”
		0		39920			”
Isopropyl chloride, .	$(CH_3)_2CHCl$	(*b*) 37	00522	34850			”
		0		38445			”
Propyl bromide, . .	$CH_3CH_2CH_2Br$	(*b*) 70·8	00546	32450	44469		”
		0		40820			”
Isopropyl bromide, .	$(CH_3)_2CHBr$	(*b*) 60	00511	33870	46751		”
		0		42020			”
Propyl iodide, . .	$CH_3.CH_2.CH_2I$	(*b*) 102	00553	31900	39053		”
		0		43880			”
Isopropyl iodide, . .	$(CH_3)_2CHI$	(*b*) 89·3	0052	33950			”
		0		45105			”
Butyl chloride, . .	$CH_3CH_2CH_2CH_2Cl$	(*b*) 78	00515	34350	54932		”
		0		44170			”
Butyl chloride (Secondary),	$\left.\begin{matrix}CH_3\\CH_3.CH_2\end{matrix}\right\rangle CHCl$	(*b*) 68·5	00512	34550	54492		”
		0		43215			”
Butyl chloride (Tertiary),	$(CH_3)_3 : CCl$	(*b*) 52	00493	35600	55190		”
		0		42625			”

TABLE LXX$_{L_2}$—*continued.*

Substance.	Formula.	$t°$ C.	L.	Q.	$\Gamma/10^6$.	s.	Authority.
Butyl bromide (Iso), .	$(CH_3)_2CH.CH_2Br$	(b) 92°·3	$0·0_4 00518$	34100	45800		Steudel
		0		45640			,,
Butyl iodide, . . .	$CH_3CH_2CH_2CH_2I$	(b) 30	0053	33300	40600		,,
		0		49225			,,
Butyl iodide (Secondary),	$\left.\begin{matrix}CH_3\\CH_3CH_2\end{matrix}\right>CHI$	(b) 120	00529	33400	40150		,,
		0		48150			,,
Methyl alcohol, . .	CH_4O	(b) 66·8	00781	22600	60563		,,
	(CH_3OH)	0		28180			,,
		0	0361	277000		$0·0_7 87$	Winkelmann
Ethyl alcohol, . .	C_2H_6O	(b) 78·4	00696	25300	57658		Steudel
	(C_2H_5OH)	0		32690			,,
		0	033				Puluj
		0	0273	366000			Winkelmann
		0	0259	386000			,,
Propyl alcohol, . .	C_3H_8O	(b) 97·4	00625	28300	57728		Steudel
	$(CH_3CH_2CH_2OH)$	0		36080			,,
		0	0203	493000			Winkelmann
Isopropyl alcohol, . .	C_3H_8O	(b) 82·8	00694	25500	50936		Steudel
	$\{(CH_3)_2CH.OH\}$	0		33210			,,
Butyl alcohol, . .	$C_4H_{10}O$	(b) 116·9	00584	30300	58160		,,
	$\{CH_3CH_2CH_2CH_2OH\}$	0		43260			,,
		0	0164	609000			Winkelmann
Butyl alcohol (Iso), .	$C_4H_{10}O$	(b) 108·4	00582	30400	56620		Steudel
	$\{(CH_3)_2CHCH_2OH\}$	0		42440			,,
		0	0168	595000			Winkelmann
Butyl alcohol (Tertiary),	$C_4H_{10}O$	(b) 82·9	00624	28300	51026		Steudel
	$(CH_3)_3 : COH$	0		36880			,,
Ethyl ether, . . .	$C_4H_{10}O$	0	022				Puluj
	$\{C_2H_5.O.C_2H_5\}$	0	197	508000		$0·0_6 119$	Winkelmann
		0				$0·0_7 76$	Jäger

		0	0241	73203			*
		0		89700			O. E. Meyer, calculated from Winkelmann
		0		80380			O.E.Meyer, from Puluj
Amyl alcohol,	$C_5H_{12}O$	0	0139	716000		88	Winkelmann
	$\{CH_3CH_2CH_2CH_2.CH_2OH\}$	0		127000			O. E. Meyer
,, ,, (fermentation),	$C_5H_{12}O$	0	0137	730000			Winkelmann
Hexyl alcohol,	$C_6H_{14}O$	0	0111	901000		81	,,
		0		159300			O. E. Meyer
Acetone,	C_3H_6O	0	026			0_6111	Puluj
	$\{CH_3.CO.CH_3\}$	0				071	Jäger.
		0	0286	61907			*
Formic acid,	CH_2O_2 ; (HCOOH)	0	0403	248000		089	Winkelmann
		0		43900			O. E. Meyer
Acetic ,,	$C_2H_4O_2$	0	0297	337000		099	Winkelmann
	$\{CH_3COOH\}$	0		59500			O. E. Meyer
Methyl formate,	$C_2H_4O_2$	(b) 32·3	00704	25110	46420		L. Meyer & Schumann
	$\{HCOOCH_3\}$	32·3	03906	45260			Schumann
		0	0312	321000		113	Winkelmann
		0		56700			O. E. Meyer
		0	03255	54303			*
Propionic acid,	$C_3H_6O_2$	0	0227	441000		101	Winkelmann
	$\{C_2H_5COOH\}$	0		77900			O. E. Meyer
Methyl acetate,	$C_3H_6O_2$	(b) 57·3	00576	30260	53144	037	L. Meyer & Schumann
	$\{CH_3COOCH_3\}$	0	0224	447000		104	Winkelmann
		0		78900			O. E. Meyer
Ethyl formate,	$C_3H_6O_2$	(b) 54·3	00578	30560	52750		L. Meyer & Schumann
	$\{HCOOC_2H_5\}$	46·2	027	370000			Winkelmann
		0	0212			099	,,
		0		83500			O. E. Meyer
Butyric acid,	$C_4H_8O_2$	0	0166	602000		088	Winkelmann
	$\{CH_3CH_2CH_2COOH\}$	0		106500			O. E. Meyer
Isobutyric acid,	$C_4H_8O_2$						
	$\{(CH_3)_2CHCOOH\}$	0	0171	585000			Winkelmann
Methyl propionate,	$C_4H_8O_2$	(b) 79·6	00544	31775	53382		L. Meyer & Schumann

TABLE LXXL_2.—*continued.*

Substance.	Formula.	$t°$ C.	L.	Q.	$\Gamma/10^6$.	s.	Authority.
Methyl propionate, . .	$\{C_2H_5COOCH_3\}$	0°	$0{\cdot}0_4 0191$	524000		$0{\cdot}0_6 105$	Winkelmann
		0		92600			O. E. Meyer
Ethyl acetate, . .	$C_4H_8O_2$	(*b*) 77·1	00548	32250	52790		L. Meyer & Schumann
	$\{CH_3COOC_2H_5\}$	0	0173	578000		101	Winkelmann
		0		102000			O. E. Meyer
Propyl formate, . .	$C_4H_8O_2$	(*b*) 80·4	00562	31440	51761		L. Meyer & Schumann
	$\{H.COOC_3H_7\}$	0	0179	559000			Winkelmann
		0		98900			O. E. Meyer
Isovaleric acid, . .	$C_5H_{10}O_2$	0	0124	806800		08	Winkelmann
	$\{(CH_3)_2CH.CH_2COOH\}$	0		142600			O. E. Meyer
Methyl butyrate, . .	$C_5H_{10}O_2$	0	0153	654000		099	Winkelmann
	$\{CH_3CH_2CH_2COOCH_3\}$		0209	84618			*
,, isobutyrate, .	$C_5H_{10}O_2$	(*b*) 92	00508	34830	54015		L. Meyer & Schumann
	$\{(CH_3)_2CHCOOCH_3\}$	92	03627	48740			Schumann
		0	0159	629000		107	Winkelmann
		0	02	499000			,,
		0		111200			O. E. Meyer
		0		88400			,,
Ethyl propionate, . .	$C_5H_{10}O_2$	(*b*) 122·2	0052	33960	53231		L. Meyer & Schumann
	$\{C_2H_5COOC_2H_5\}$	122·2	03787	46690			Schumann
		90·3	0268	373000			Winkelmann
		0	0152	658000		101	,,
		0	0202	496000			,,
		0	0204	86600			*
		0		116300			O. E. Meyer
		0		87500			,,
Propyl acetate, . .	$C_5H_{10}O_2$	(*b*) 100·9	00541	32660	51164		L. Meyer & Schumann
	$\{CH_3COOC_3H_7\}$	100·9	03724	47470			Schumann
		0	0195	512000		131	Winkelmann
		0		90700			O. E. Meyer
		0	02043	86544			*

Isobutyl formate,	$C_5H_{10}O_2$	(*b*) 97·9	00577	30450	47903		L. Meyer & Schumann
	$\{HCOOC_4H_9\}$	97·9	03828	46190			Winkelmann
		0	0204	490000		141	”
		0		86700			O. E. Meyer
		0	02127	83100			*
Methyl valerate,	$C_6H_{12}O_2$	(*b*) 116·7	00528	33500	50606		L. Meyer & Schumann
	$\{C_4H_9COOCH_3\}$	0	0133				Winkelmann
Ethyl butyrate,	$C_6H_{12}O_2$	(*b*) 119·8	00522	33870	51150		L. Meyer & Schumann
	$\{C_3H_7COOC_2H_5\}$	0	0137	730000		106	Winkelmann
		0		129300			O. E. Meyer
” isobutyrate,	$C_6H_{12}O_2$	(*b*) 110·2	00482	36650	54709		L. Meyer & Schumann
	$\{(CH_3)_2CHCOOC_2H_5\}$	0	0144	694000		112	Winkelmann
		0		123000			O. E. Meyer
Propyl propionate,	$C_6H_{12}O_2$	(*b*) 136·8	00502	35240	53286		L. Meyer & Schumann
	$\{C_2H_5COOC_3H_7\}$	0	0130	769000		100	Winkelmann
		0		136300			O. E. Meyer
Isobutyl acetate,	$C_6H_{12}O_2$	(*b*) 116·4	00503	35180	52843		L. Meyer & Schumann
	$\{CH_3COOCH_2CH(CH_3)_2\}$	116·4	03815	46350			Schumann
		0	0132	758000			Winkelmann
		0	0184	544000			”
		0		133600			O. E. Meyer
		0	01959	90250			*
Amyl formate,	$C_6H_{12}O_2$	(*b*) 123·2	00525	33640	51086		L. Meyer & Schumann
	$\{H.COOC_5H_{11}\}$						
Ethyl valerate,	$C_7H_{14}O_2$	(*b*) 134·4	00519	34020	49500		L. Meyer & Schumann
	$\{C_4H_9COOC_2H_5\}$	0	0119	840000		104	Winkelmann
		0		149000			O. E. Meyer
Propyl butyrate,	$C_7H_{14}O_2$	(*b*) 142·7	00518	34150	50116		L. Meyer & Schumann
	$\{C_3H_7COOC_3H_7\}$	0	0122	820000		108	Winkelmann
		0		145600			O. E. Meyer
” isobutyrate,	$C_7H_{14}O_2$	(*b*) 135	00479	36900	53530		L. Meyer & Schumann
	$\{(CH_3)_2CHCOOC_3H_7\}$	0	0128	781000			Winkelmann
		0		137700			O. E. Meyer
Isobutyl propionate,	$C_7H_{14}O_2$	(*b*) 136·8	00514	34400	50136		L. Meyer & Schumann
	$\{C_2H_5COOCH_2CH(CH_3)_2\}$	0	0116	862000			Winkelmann
		0		152400			O. E. Meyer

TABLE LXXL$_2$.—*continued.*

Substance.	Formula.	$t°$ C.	L.	Q.	Γ/10^6.	s.	Authority.
Propyl valerate, . .	$C_8H_{16}O_2$	(*b*) 155°·9	$0·0_4 00507$	34530	49408		L. Meyer & Schumann
	$\{C_4H_9COOC_3H_7\}$	0	0108	926000			Winkelmann
		0		163700			O. E. Meyer
Isobutyl butyrate, . .	$C_8H_{16}O_2$	(*b*) 156·9	00512	34570	48965		L. Meyer & Schumann
	$\{C_3H_7COOCH_2CH(CH_3)_2\}$	0	0107	935000		$0·0_6 105$	Winkelmann
		0		165700			O. E. Meyer
,, isobutyrate, .	$C_8H_{16}O_2$	(*b*) 146·5	00476	37070	52038		L. Meyer & Schumann
	$\{(CH_3)_2CHCOOCH_2CH(CH_3)_2\}$	0	0107	932000			Winkelmann
		0		165200			O. E. Meyer
Amyl propionate, . .	$C_8H_{16}O_2$	(*b*) 160·2	00486	36350	51811		L. Meyer & Schumann
	$\{C_2H_5COOC_5H_{11}\}$	0	0100	1000000			Winkelmann
				177100			O. E. Meyer
Isobutyl valerate, . .	$C_9H_{18}O_2$	(*b*) 168·7	00465	38870	53354		L. Meyer & Schumann
	$\{C_4H_9COOCH_2CH(CH_3)_2\}$	0	00948	1055000			Winkelmann
				186500			O. E. Meyer
Amyl butyrate, . .	$C_9H_{18}O_2$; $\{C_3H_7COOC_5H_{11}\}$	(*b*) 178·7	00463	38170	53024		L. Meyer & Schumann
,, isobutyrate, . .	$C_9H_{18}O_2$	(*b*) 169	00461	38350	52668		,,
	$\{(CH_3)_2CHCOOC_5H_{11}\}$	0	00952	1050000			Winkelmann
				185600			O. E. Meyer

The temperatures marked (*b*) are the boiling points of the substances under a pressure of 760 mms. of ice-cold mercury. The values on all lines marked by an asterisk * are calculated according to the compiler's formulæ from values of η, etc., given in the preceding tables.

If the molecules of a liquid be considered as spheres, ρ/d will not correspond to $n\pi s^3/6$, but to $\{n\pi s^3/6\} \times 3\sqrt{2}/\pi$, *i.e.*, to the smallest space into which n spheres of the diameter s can be compressed without distortion; so equation (22) becomes

$$\rho/d = \tfrac{1}{6}n\pi s^3 \times 3\sqrt{2}/\pi = \tfrac{1}{3}ns^3\sqrt{2}, \qquad (32)$$

or

$$\mathfrak{v} = \tfrac{1}{6}n\pi s^3 = (\rho/d) \times 0·74048049 = 0·74048049\,\mathfrak{b}, \qquad (32\text{A})$$

Thus we see that the values for $\mathfrak{v}$ calculated from dielectric capacities or from the indices of refraction should be much smaller than the values of $\mathfrak{b}$ deduced from the coefficients of condensation or from deviations from Boyle's law: in fact, the values actually calculated according to (27A) or (28A) differ from those of $\mathfrak{b}$ to a far greater extent than one would expect from (32A).

TABLE LXXм.—Values of *d*, *v*, L and *s*. (O. E. Meyer's calculations.)

Substance.	*d*	*v*	L	*s*
Hydrogen,	0·07	0·00203	$0{\cdot}0_4178$	$0{\cdot}0_6306$
Nitrogen,	0·905	219	095	176
Oxygen,	1·24	182	102	157
Chlorine,	1·6602	301	046	117
Hydrogen chloride,	0·908	282	071	170
Water vapour,	1·000	282	071	170
Hydrogen sulphide,	0·9	267	060	136
Carbon dioxide,	1·057	293	065	162
Nitrous oxide,	1·003	311	065	171
Sulphur dioxide,	1·49	303	047	121
Carbon disulphide,	1·29215	415	0290	102
,, ,,	,,	,,	0255	090
Ammonia,	0·6954	173	071	104
Cyanogen,	0·866	424	040	144
Methane,	0·4148	266	080	181
Methyl chloride,	0·9831	368	044	138
Chloroform,	1·5264	551	024	112
Ethylene,	0·414	477	042	170
Ethyl chloride,	0·925	488	036	149
Benzol,	0·899	612	022	113
,,	,,	,,	019	099
Acetone,	0·8125	503	026	111
Methyl alcohol,	0·796	284	0361	087
Ethyl ,,	0·794	409	0273	095
Propyl ,,	0·8205	516	0203	089
Butyl alcohol,	0·8239	633	0164	088
Isobutyl ,,	0·8168	639	0168	091
Ethyl ether,	0·736	709	0197	119
Amyl alcohol,	0·8296	748	0139	088
Hexyl ,,	0·8333	863	0111	081
Formic acid,	1·245	260	0403	089
Acetic ,,	1·08005	392	0297	099
Methyl formate,	0 9928	426	0312	113
Propionic acid,	0·9961	524	0227	101
Methyl acetate,	0·9562	546	0224	104
Ethyl formate,	0·9447	552	0212	099
Butyric acid,	0·9886	628	0166	088
Methyl propionate,	0·9573	648	0191	105
Ethyl acetate,	0·8981	691	0173	101
Isovaleric acid,	0·9467	760	0124	080

TABLE LXXM.—*continued.*

Substance.	d	$\mathfrak{v}$	L	s
Methyl butyrate,	0·9475	0·00759	$0{\cdot}0_4 0153$	$0{\cdot}0_6 099$
,, isobutyrate,	0·9056	794	0159	107
Ethyl propionate,	0·9139	787	0152	101
Propyl acetate,	0·910	790	0195	131
Isobutyl formate,	0·8845	813	0204	141
Ethyl butyrate,	0·8978	911	0137	106
,, isobutyrate,	0·890	919	0144	112
Propyl propionate,	0·9022	907	0130	100
Ethyl valerate,	0·894	1025	0119	104
Propyl butyrate,	0·8789	1043	0122	108
Isobutyl butyrate,	0·8798	1154	0107	105

From the values given on p. 426 for the quantity b, van der Waals has calculated the values of $\mathfrak{s}$ for—

Air, $0{\cdot}0_7 80$
CO_2, 63
H_2, 40

As pointed out by Roth, b is not an absolute constant, but varies to a considerable extent with the temperature, and any values calculated from b can be but roughly approximate at best. As first approximations, the following values for $\mathfrak{v}$, calculated from the values ϕ in Table LXIX., may be of interest. The values in column A are calculated on the hypothesis that $b = 4\mathfrak{b} = (12\sqrt{2}/\pi)\mathfrak{v}$, and those in column B by taking $b = (5/2)\mathfrak{b} = (5\sqrt{2}/2\pi)\mathfrak{v}$.

TABLE LXXN.—Values of $\mathfrak{v}$ calculated from Critical Volume.

Substance.	Values of $\mathfrak{v}$.		Substance.	Values of $\mathfrak{v}$.	
	A.	B.		A.	B.
Nitrogen, . . .	0·000284	0·000454	Methyl-ethyl ether, .	0·000539	0·000862
Oxygen, . . .	249	399	Ethyl ether, . .	0823	1317
Bromine, . . .	373	597	Acetic acid, . .	0407	0652
Carbon dioxide,. .	407	652	Ethyl formate, . .	0602	0963
Nitrous oxide, . .	296	474	Propyl ,, . .	0742	1188
Nitrogen peroxide, .	255	408	Isobutyl ,, . .	1055	1688
Sulphur dioxide, .	362	580	Methyl acetate, .	0592	0948
Ethylene, . . .	351	562	Ethyl ,, . .	0754	1206
Water, . . .	238	381	Propyl ,, . .	0903	1445
Carbon disulphide, .	592	948	Isobutyl ,, . .	1059	1695
Benzol, . . .	605	968	Methyl propionate, .	0755	1208
Ethyl alcohol, . .	440	704	Ethyl ,, .	0914	1463
Propyl ,, . .	597	956	Methyl butyrate, .	0898	1437
Ethylene chloride, .	606	970	Ethyl ,, .	1067	1707
Ethylidene ,, .	606	970	Ethyl isobutyrate, .	1070	1713
Propyl ,, .	606	970	Methyl valerate, .	1057	1692
Chlorbenzol, . .	725	1160			

It will be seen that these values are much lower than those arrived at by other methods, but they will be found in closer agreement with those calculated from electrical and optical data.

TABLE LXXo.—Values of $\mathfrak{b}$, $\mathfrak{v}$, etc., for some difficultly Liquefiable Gases.

(From the data supplied by Ramsay, Dewar, and others.)

	Boiling Point on Absolute Scale.	Density of Liquid at Boiling Point. d.	Weight of 1 Litre of Gas at Boiling Point under 760 mms. Pressure. 1000 S.	$\mathfrak{b}=\rho/d$.	$\mathfrak{v}=\eta\pi s^3/6$.	$\mathfrak{v}_o=\eta_o\pi s^3/6$.
				At Boiling Point under 760 mms.		Space occupied by all the Mol. Spheres in 1 c.cm. of the Gas at 0° C. under 760 mms. Pressure.
Hydrogen, .	20°	0·06	1·2266	0·02044	0·01414	0·001036
Nitrogen, .	77·54	0·791	4·4073	00557	00413	1172
Oxygen, .	90·5	1·131	4·3047	389	285	0945
Fluorine, .	186	1·11	2·4863	224	166	1130
Chlorine, .	239	1·507	3·6111	240	177	1553
Argon,	86·9	1·212	5·6462	466	345	1098
Krypton, .	121·33	2·155	8·2902	385	285	1266
Xenon, .	163·9	3·52	9·5802	272	201	1210
Methane, .	108·3	0·416	1·8020	433	321	0658
Ethylene, .	169·5	0·571	2·0133	353	261	1102

The numbers in the third column have been calculated from the molecular weights, and the values of $\mathfrak{v}$ and v at the various boiling points may therefore be considered as the lowest limits of possible values.

The exceedingly high values obtained by O. E. Meyer and others for ς and other constants of hydrogen are evidently erroneous; $\mathfrak{v}$ and v at boiling point would naturally be large, but so also would n, and from the physical properties of hydrogen we should expect ς to be comparatively small.

TABLE LXXp.—Molecular Volumes, etc., of Liquids.

As far back as 1842, Kopp pointed out the dependence of the "Molecular Volume" on the chemical constitution, and since that time a great deal of work has been done, having for its object the determination of the laws which connect the molecular volumes of liquids with their chemical constitution. The comparing of the values for different liquids has been facilitated by calculating the molecular volumes at such temperatures as would give corresponding values for some important physical constant of all the liquids concerned, *e.g.*, by taking d = density of the liquid at its boiling point under atmospheric pressure, we get the values of $\mathfrak{M}/d$ for all liquids when they have the same vapour pressure. Possibly more accordant results would be obtained if we could find d when the viscosity was the same for all the substances concerned.

Taking the weight of one atom of hydrogen as our unit for $\mathfrak{M}$, then the space occupied at 4° C. by this weight of water will be the unit in the values of the molecular volumes; or if $\mathfrak{M}$ be considered as the "Mol" or gramme molecule, then the molecular volumes will be expressed in centimetre cubes.

The liquids experimented with have been mostly organic compounds, as the paucity of the elements entering into the formation of these has greatly facilitated comparisons.

From the results obtained by Kopp and subsequent investigators, Lothar Meyer concluded that "The atomic volumes of elements (at least several of them) in their liquid combinations are proportional to the spaces occupied by their atoms in the gaseous state."

H. Kopp found that the addition of the group CH_2 to an organic compound corresponded to an increment of 22 in the molecular volume; thus

		Δ	
Formic acid, .	$CH_2O_2 \equiv 41{\cdot}8$		
Acetic acid, .	$C_2H_4O_2 \equiv 63{\cdot}5$	21·7	mean 22
Propionic acid,	$C_3H_6O_2 \equiv 85{\cdot}4$	21·9	
Butyric acid, .	$C_4H_8O_2 \equiv 107{\cdot}8$	22·4	

Also that the atomic volume of carbon is double that of hydrogen; for

Octane, . .	$C_8H_{18} \equiv 184{\cdot}6$
Cymol, . .	$C_{10}H_{14} \equiv 184{\cdot}6$

and therefore

$$C_2 \equiv H_4,$$

and in this way he inferred that

$$C \equiv 11, \text{ and } H \equiv 5{\cdot}5.$$

The following values for the atomic volumes in liquids at the boiling points thereof have been adopted by various investigators :—

	Kopp.	Loschmidt.	Lossen.	Thorpe.
Hydrogen,	5·5	3·5	5·05 ; 5·225	
Carbon,	11	14	10·1 ; 10·45	
Nitrogen (in ammonias),	2·3		7	
„ (in CN group),	17	13		
„ (in nitro-derivatives),	8·6			
Oxygen (hydroxylic),	7·8	11	10·1 ; 10·45	
„ (carboxylic),	12·2	(O_2)21		
Fluorine,				9·2
Silicon,	32			30
Phosphorus (Triad),	25·4		25·9	25·3
„ (Pentad),			19·3	
Sulphur (C – S),	22·6		23·5	22·6
„ (C = S),	28·6	26		28·6
Chlorine,	22·8	21·8	22·8	22·7
Titanium,	35			33·7
Vanadium,				30·4
Chromium,				24·5
Zinc,				40·3
Arsenic,	26			26·3
Bromine (Br_2),				53·6
„ (Br),	27·8		29·1	28·1
Tin,	40			
Antimony,	33			28·6
Iodine,	37·5		39·6	36
CN,	28	28	30	
NO_2,	33		32·6	32
CH_2,	22		20·9	

Thus for a compound of the formula $C_xH_yO_z\mathbf{O}_w$, where O denotes hydroxylic oxygen or oxygen joined by one bond only to one carbon atom, and **O** denotes carboxylic oxygen, *i.e.*, oxygen doubly linked to one carbon atom, we get, according to Kopp—

$$V = 11x + 5{\cdot}5y + 7{\cdot}8z + 12{\cdot}2w.$$

Lossen has employed formulæ, etc., that differ considerably from those of Kopp ; thus for the acids and esters $C_nH_{2n}O_2$ he finds that

$$C_2H_4O_2 \equiv 62{\cdot}7,$$

and employs, for the general calculation of molecular volumes, the equation

Molecular volume of $C_nH_{2n}O_2$

$$= 62{\cdot}7 + (n-2)20{\cdot}9 + \left(\tfrac{1}{2} + \tfrac{2}{2} + \tfrac{3}{2} + \cdots \frac{n-3}{2}\right)$$

$$= 62{\cdot}7 + (n-2)20{\cdot}9 + \tfrac{1}{4}(n-2)^2.$$

He modifies this expression in several ways so as to make it applicable to different classes of compounds; thus for saturated compounds:—

Molecular volume of $C_nH_mO_p$

$$= 10{\cdot}45n + 5{\cdot}225m + 10{\cdot}45p + \tfrac{1}{4}(n - 2)^2$$
$$= 10{\cdot}16(n + p) + 5{\cdot}08m + 0{\cdot}23n^2.$$

For unsaturated compounds:—

Molecular volume of $C_nH_mO_p(\mu)$

$$= 10{\cdot}45(n + p) + 5{\cdot}225m + \tfrac{1}{4}(n - 2)^2 + 1{\cdot}5\mu,$$

where μ represents the number of hydrogen atoms required to convert the formula into that of a saturated compound. For alcohols this formula is best written as follows:—

Molecular volume of $C_nH_mO_p(\mu)$

$$= 10{\cdot}1(n + p) + 5{\cdot}05m + \tfrac{1}{4}(n - 2)^2 + 1{\cdot}35\mu.$$

A still more general form of the expression is

Molecular volume of $C_nH_mO_p(\mu)$

$$= (10{\cdot}24 \pm 0{\cdot}5x)(n + p) + (5{\cdot}12 \pm 0{\cdot}25x)m + \tfrac{1}{4}(n - 2)^2 + 1{\cdot}4\mu,$$

where x is a number varying between 0 and 1 for various homologous series, but remaining constant for members of the same series.

Traube considers that the so-called "Atomic Volumes" are made up of two distinct portions—(a) the space actually filled by the material nucleus or atom, and (b) the space in which this nucleus performs its oscillatory or other intramolecular movements; a probably remains constant under all conditions, but we should expect b to vary considerably with the nature and intensity of atomic movements. This investigator has found that the sum $a + b$ does vary considerably for various elements, *e.g.*, for N in several primary amines $a + b = 1{\cdot}5$, but in tri-isobutyl amine $a + b$ for $N = 13$. The molecular volume $\mathfrak{M}/d$ he considers to be made up of the sum of the atomic volumes and a magnitude which he terms the "Co-volume," varying with the temperature.

$$\text{Co-volume (of liquid or solid) at } t^\circ \text{ C.} = 24{\cdot}5(1 + at),$$

where a = coefficient of expansion for gases. At 15° C. the value becomes 25·9 practically.

Traube has given us the following values for the sum of $a + b$ at or near 15° C.:—

H ≡ 3·1.
C ≡ 9·9.
N ≡ 1·5 in primary amines.
N ≡ 10·7 Pentavalent.
N ≡ 8·5 to 10·7 in nitro-derivatives.
N ≡ 13 (about) in some tertiary amines.
O ≡ 5·5 Doubly linked to carbon, either one or two C atoms.
O ≡ 2·3 Extra-radicle.
O ≡ 0·4 in OH in $O = C - O - H$, etc.
P ≡ 17·0 Trivalent.
P ≡ 28·5 Pentavalent.
S ≡ 15·5 Sulpho-hydryl, sulpho-carbonyl.
S ≡ 10 to 11·5 united to oxygen.
Cl ≡ 13·2.
Br ≡ 17·7.
I ≡ 21·4.
CH_2 ≡ 16·1; 15·97 @ 0°; 17·13 @ 100°.
CN ≡ 13·2.

Traube's formula for the molecular volume at 15° C., is

$$\mathfrak{M}/d_{15} = \text{Sum of atomic volumes} + 25{\cdot}9.$$

On liquefaction we know that many substances undergo polymerisation, and if we deduce $\mathfrak{M}$ from vapour density, etc., we have to remember that

$$\text{M} = \text{molecular weight of liquid} = n\mathfrak{M},$$

and

$$\text{M}/d_{15} = \{n \times \text{sum of atomic volumes in vapour mol.}\} + 25{\cdot}9,$$

or

$$\mathfrak{M}/d_{15} = \Sigma\,(\text{atomic volumes}) + 25{\cdot}9/n.$$

From this we can determine the "Association Factor" n, *i.e.*, the mean number of gaseous particles that combine to form one liquid particle.

Traube's values for n are :—

For Acetic acid,	1·40
Ethyl alcohol,	1 51
Methyl alcohol,	1·66
Formic acid,	1·67
Glycerine,	1·75
Glycol,	2·00
Water,	above 3

TABLE LXXP.—**Comparison of Molecular Volumes in th**

Name.	Formula.	Boiling Point.	Density at 0°.	Density at Boilin Point.
Water, ...	H_2O	100° C.		0·95865
		100°·3 (763·1)		0·9588
Bromine, . . .	Br_2	59 ·27	3·18828	2·98218
Carbon disulphide, .	CS_2	47°		
		46 ·04	1·29215	1·22242
		46		
		43		1·2176
Nitric peroxide, . .	N_2O_4	21 ·6	1·4903	1·43958
Sulphur dioxide, . .	SO_2	−8		
,, trioxide, . .	SO_3	47		
,, chloride, . .	S_2Cl_2	138 ·1	1·70941	1·49201
Thionyl chloride, . .	$SOCl_2$	78 ·8	1·67673	1·52143
Chlorosulphonic acid, .	SO_3HCl	155 ·3	1·78474	1·54874
Sulphuryl chloride, .	SO_2Cl_2	70	1·70814	1·56025
Pyrosulphuryl chloride, .	$S_2O_5Cl_2$	139 ·6	1·85846	1·60610
Phosphorus trichloride, .	PCl_3	78		
		76	1·61275	1·46845
		76		
,, tribromide, .	PBr_3	172 ·9	2·92311	2·49541
,, oxychloride, .	$POCl_3$	107 ·23	1·71163	1·50967
		110		
,, sulphochloride,	$PSCl_3$	125 ·12	1·66820	1·45599
Phosphorylbromo-chloride, ...	$POCl_2Br$	137 ·6	2·12065	1·83844
Arsenic trichloride, .	$AsCl_3$	133 ·5		
		130 ·21	2·20500	1·91813
,, trifluoride, .	AsF_3	60 ·4	2·6659	2·4497
Antimony trichloride, .	$SbCl_3$	223		
,, tribromide, .	$SbBr_3$	275		
Vanadyl chloride, . .	$VOCl_3$	127 ·2	1·86534	1·63073
Chromyl ,, . .	CrO_2Cl_2	115 ·9	1·96101	1·75780
Silicon tetrachloride, .	$SiCl_4$	59		
		57 ·6	1·52408	1·40294
,, tetrabromide, .	$SiBr_4$	153		
Titanium tetrachloride,	$TiCl_4$	136		
		136 ·4	1·76041	1·52223
Tin tetrachloride, . .	$SnCl_4$	115		
		113 ·9	2·27875	1·97813
Valerylene, . . .	$CH_3.C:C:CH_2.CH_3$	41		
Amylene, . . .	C_5H_{10}	33		
		36 ·6		0·6357
Secondary pentane, .	$(CH_3)_2CH.CH_2CH_3$	31		6132
Diallyl, . . .	C_6H_{10}	59 ·1		
		59 ·3	0·7074	6508
		59 ·3		6503
Normal hexane, . .	$CH_3.CH_2CH_2CH_2CH_2CH_3$	68 ·7		6143
		69	6753	6129
Di-isopropyl, . .	$(CH_3)_2CH.CH(CH_3)_2$	58	6829	6286
Heptane, . . .	C_7H_{16}	91		6060
		98 ·43	70048	61389
Ethyl-amyl (iso), . .	$CH_3(CH_2)_3CH(CH_3)_2$	90 ·3	69692	61606
Caprylene, . . .	C_8H_{16}	123 ·5		6306

Liquid and Gaseous States at Normal Boiling Points.

$V_t = V_o$ multiplied by	Molecular Volume at Boiling Point. Liquid.	Gaseous.	𝔟 at Boiling Point.	𝔳 at Boiling Point.	
	18·8	29865·6	$0\cdot0_20629$	$0\cdot0_20466$	K
	18·73	29865·6	0627	0464	S
$1 + \cdot0_2106218t + \cdot0_5187714t^2 - \cdot0_83085t^3$	53·48				Th
$1 + \cdot0_211398t + \cdot0_513707t^2 + \cdot0_719123t^3$	62·2	25621·9	2428	1797	P
$1 + \cdot0_2115056t + \cdot0_5111621t^2 + \cdot0_717476t^3$	62·11	25541·8	2432	1801	Th
$1 + \cdot0_211506t + \cdot0_5111621t^2 + \cdot0_717475t^3$	62	25541·8	2427	1797	B
	62·3	25301·6	2462	1823	K
$1 + \cdot0_21591t - \cdot0_5397015t^2 + \cdot0_62153t^3$	63·95	23588·1	2711	2008	Th
V_{26} instead of V_0					
$1 + \cdot0_2149638(t+26) + \cdot0_4223375(t+26)^2 - \cdot0_6495759(t+26)^3$	43·9	21218·0	2069	1532	P
	44·1	25621·9	1721	1274	B
$1 + \cdot0_39591t - \cdot0_73819t^2 + \cdot0_873186t^3$	90·28	32916·3	2743	2031	Th
$1 + \cdot0_2116149t + \cdot0_691418t^2 + \cdot0_895368t^3$	94·37				Th
$1 + \cdot0_390505t + \cdot0_6118647t^2 + \cdot0_823943t^3$	75·05	34293·5	2188	1620	Th
$1 + \cdot0_2123065t + \cdot0_675375t^2 + \cdot0_714587t^3$	86·29	27463·5	3142	2299	Th
$1 + \cdot0_396830t + \cdot0_6867098t^2 + \cdot0_718623t^3$	133·55	33036·4	4043	2993	Th
$1 + \cdot0_21128619t + \cdot0_687288t^2 + \cdot0_717924t^3$	93·9	28104·1	3341	2474	P
$1 + \cdot0_211592t + \cdot0_511637t^2 + \cdot0_88029t^3$	93·34	27943·9	3340	2473	Th
$1 + \cdot0_2113937t + \cdot0_5166807t^2 + \cdot0_84012t^3$	93·4	27943·9	3342	2475	B
$1 + \cdot0_384117t + \cdot0_6542892t^2 + \cdot0_818893t^3$	108·28	35702·7	3033	2246	Th
$1 + \cdot0_2106431t + \cdot0_511266t^2 + \cdot0_85299t^3$	101·37	30414·5	3330	2466	Th
	101·8	30666·3	3323	2461	B
$1 + \cdot0_2100849t + \cdot0_665582t^2 + \cdot0_847455t^3$	116·11	31877·0	3642	2697	Th
$1 + \cdot0_2100518t + \cdot0_6490530t^2 + \cdot0_844065t^3$	107·38	32876·2	3266	2419	Th
$1 + \cdot0_3979073t + \cdot0_69669482t^2 + \cdot0_817772t^3$	94·8	32547·9	2913	2157	P
$1 + \cdot0_399134t + \cdot0_684914t^2 + \cdot0_827551t^3$	94·27	32283·7	2920	2163	Th
$1 + \cdot0_21443t + \cdot0_6297t^2$	53·84	26694·8	2017	1493	Th
V_{73} instead of V_0					
$1 + \cdot0_48054(t-73) + \cdot0_51033(t-73)^2$	100·7	39714·2	2536	1898	P
V_{90} instead of V_0					
$1 + \cdot0_3576(t-90) + \cdot0_513465(t-90)^2$	116·8	43877·8	2662	1971	P
$1 + \cdot0_3965236t + \cdot0_689826t^2 + \cdot0_8319163t^3$	106·25	32043·5	3316	2455	Th
$1 + \cdot0_395860t + \cdot0_610737t^2 + \cdot0_81962t^3$	88·21	31138·7	2833	2098	Th
$1 + \cdot0_21294119t + \cdot0_52184144t^2 + \cdot0_7408642t^3$	122·1	36582·7	4593	3401	P
$1 + \cdot0_2133095t + 0_5280978t^2 + \cdot0_821566t^3$	120·81	26470·6	4564	3380	Th
$1 + \cdot0_395257t + \cdot0_675674t^2 + \cdot0_92921t^3$	144·3	34109·3	4231	3133	P
$1 + \cdot0_3942569t + \cdot0_51345794t^2 + \cdot0_9888t^3$	126	32748·1	3847	2849	P
$1 + \cdot0_3982612t + \cdot0_6505528t^2 + \cdot0_8513052t^3$	124·47	32780·1	3797	2811	Th
$1 + \cdot0_2113280t + \cdot0_691171t^2 + \cdot0_875798t^3$	131·4	31066·6	4230	3132	P
$1 + \cdot0_2116055t + \cdot0_664617t^2 + \cdot0_87727t^3$	131·07	30978·6	4231	3133	Th
	104	25141·5	4137	3063	B
	112	24500·9	4571	3305	B
	109·95	24789·2	4435	3284	S
	117·17	24340·8	4814	3565	S
	126·5	26590·7	4757	3522	B
$1 + \cdot0_213423t - \cdot0_634339t^2 + \cdot0_738693t^3$	125·7	26606·7	4724	3498	Z
	125·82	26606·7	4729	3502	S
	139·72	27359·4	5107	3782	S
$1 + \cdot0_212948t + \cdot0_514741t^2 + \cdot0_712363t^3$	139·8	27383·4	5105	3780	Z
$1 + \cdot0_213147t + \cdot0_515210t^2 + \cdot0_725591t^3$	136·3	26502·7	5143	3808	Z
	165	29145·0	5661	4192	Sr
$1 + \cdot0_2121023t + \cdot0_511133t^2 + 0_71174t^3$	162·56	29761·5	5462	4045	Th
$1 + \cdot0_212394t + \cdot0_5119318t^2 + \cdot0_71306t^3$	161·98	29088·9	5568	4123	Th
	177·22	31747·2	5582	4133	S

TABLE LXX

Name.	Formula.	Boiling Point.	Density at 0°.	Density at Boiling Point.
Di-isobutyl, . . .	$(CH_3)_2CH.CH_2.CH_2CH(CH_3)_2$	108		
		108° C.		0·6167
		108 ·5	0·71110	61549
Diamylene, . . .	$C_{10}H_{20}$	156 ·3		6615
Di-isoamyl, . . .	$(CH_3)_2.CH.(CH_2)_4CH:(CH_3)_2$	159 ·6		6126
Benzol, ...	C_6H_6	80		
		80 ·1		8111
Toluol, ...	C_7H_8	109 ·2		7780
Hexahydrotoluol, . .	C_7H_{14} ; $CH_3.C_6H_{11}$	97	7741	6896
Phenyl acetylene, . .	C_8H_6 ; $C_6H_5.C:CH$	141 ·6	94658	80832
Styrol, ...	$C_8H_8 : C_6H_5\ CH : CH_2$	144		7926
		146 ·2	9251	7914
Ortho xylol, . . .	C_8H_{10} ; $C_6H_4(CH_3)_2$ (1 : 2)	141 ·4		7559
		141 ·9	8932	7684
Meta ,, . . .	C_8H_{10} ; $C_6H_4(CH_3)_2$ (1 : 3)	139 ·2		7571
		138 ·9	8812	7567
Para ,, . . .	C_8H_{10} ; $C_6H_4(CH_3)_2$ (1 : 4)	138	8801	7558
		138 ·1		7543
Ethyl benzol, . .	C_8H_{10} ; $C_6H_5C_2H_5$	135 ·9	8837	76115
		136 ·5	88316	7612
Hexahydro-iso-xylol, .	CH_{16} ; $(CH_3)_2C_6H_{10}$	118	7814	6781
Propyl benzol, . .	C_9H_{12} ; $C_6H_5CH_2CH_2CH_3$	158 ·5		7399
Ethyl toluol, . .	C_9H_{12} ; $CH_3C_6H_4C_2H_5$	162 ·1		7394
Mesitylene, . . .	C_9H_{12} ; $C_6H_3(CH_3)_3$	164 ·5		7372
Naphthalene, . .	$C_{10}H_8$	218		
		217 ·1		8674
Cymol, ...	$C_{10}H_{14}$; $CH_3.C_6H_4.CH(CH_3)_2$	175		
		175 ·5		7248
Hexahydro-naphthalene,	$C_{10}H_{14}$	200	9419	7809
Turpentine, . . .	$C_{10}H_{16}$	156 ·1		7422
Carvene, . . .	$C_{10}H_{16}$	176 ·5		7127
Citronterpene, . .	$C_{10}H_{16}$	168		
Methyl alcohol, . .	CH_4O ; CH_3OH	59		
		64 ·8		7477
		66 ·2	8111	7483
Acetaldehyde, . .	C_2H_4O ; CH_3COH	21		
Ethyl alcohol, . .	C_2H_6O ; C_2H_5OH	78		
		78 ·2		7405
Allyl ,, . .	C_3H_6O ; C_3H_5OH	96 ·5		
		96 ·6	86990	77998
		96 ·5		7809
		96 ·5	8724	7830
Acetone, . . .	C_3H_6O ; $CO(CH_3)_2$	56		
		56 ·5	81858	75369
		56 ·3	8125	7489
		56 ·0		7506
Propyl alcohol, . .	C_3H_8O ; $CH_3.CH_2.CH_2.OH$	97 ·1		7367
		97 ·4	8177	7369
Isopropyl alcohol, . .	C_3H_8O ; $(CH_3)_2CH.OH$	81 ·3		7414
		82 ·9	7996	7231
Methyl ethyl ether, .	C_3H_8O ; $CH_3.O.C_2H_5$	10 ·8	7252	7127
Butyl alcohol, . .	$C_4H_{10}O$; $CH_3CH_2CH_2CH_2OH$	116 ·8		7270

—*continued.*

$V^t = V^o$ multiplied by	Molecular Volume at Boiling Point.		$\mathfrak{b}$ at Boiling Point.	$\mathfrak{v}$ at Boiling Point.	
	Liquid.	Gaseous.			
	184·5	30506·2	$0{\cdot}0_26048$	$0{\cdot}0_24478$	K
$1+{\cdot}0_2119701t+{\cdot}0_662122t^2+{\cdot}0_714166t^3$	184·49	30506·2	6048	4478	S
	184·83	30546·2	6051	4481	Th
	211·25	34373·5	6146	4551	S
$1+{\cdot}0_2117626t+{\cdot}0_5127755t^2+{\cdot}0_880648t^3$	231·31	34637·8	6678	4945	S
	95·94	28264·2	3394	2513	K
$1+{\cdot}0_21028t+{\cdot}0_51779t^2$	95·94	28272·2	3393	2512	S
$1+{\cdot}0_211436t+0_643104t^2+{\cdot}0_716551t^3$	117·97	30602·2	3855	2854	S
$1+0{\cdot}0_397275t+{\cdot}0_510587t^2+0{\cdot}0_831491t^3$	141·8	39625·4	4786	3544	Z
$1+0{\cdot}0_395069t+{\cdot}0_511580t^2+{\cdot}0_816704t^3$	125·8	33196·5	3790	2806	W
	130·91	33388·7	3921	2903	S
	131·11	33564·8			W
$1+{\cdot}0_391734t+{\cdot}0_513245t^2+{\cdot}0_819586t^3$	139·91	33180·5	3906	2892	S
	137·6	33220·5	4142	3067	Pt
$1+{\cdot}0_394866t+{\cdot}0_697463t^2+{\cdot}0_851933t^3$	139·68	33004·3	4232	3134	S
$1+{\cdot}0_397013t+{\cdot}0_68714t^2+{\cdot}0_85287t^3$	139·75	32980·3	4237	3137	Pt
	139·9				S
	138·94	32740·1	4244	3143	S
$1+0{\cdot}0_386172t+0{\cdot}0_525344t^2-0{\cdot}0_818319t^3$	138·74	32788·2	4231	3133	W
$1+{\cdot}0_210672t+{\cdot}0_510061t^2+{\cdot}0_875268t^3$	140·2	32908·3	4260	3154	Pt
	164·8	31306·9	5264	3898	Z
	161·82	34549·7	4684	3468	S
	161·94	34837·9	4648	3142	S
	162·41	35030·1	4636	3433	S
$1+0{\cdot}{}_388962t-{\cdot}0_656843t^2+{\cdot}0_842722t^3$	149·2	39313·9	3795	2810	K
	147·2	39241·8	3751	2778	Z
		35870·9			K
$1+{\cdot}0_382659t+{\cdot}0_672270t^2+{\cdot}0_814935t^3$	184·6	35910·9	5141	3807	S
	171·2	37872·6	4520	3347	Z
	182·24	34357·5	5304	3928	S
	190 30	35991·0	5287	3915	S
$1+{\cdot}0_211342t+{\cdot}0_513635t^2+{\cdot}0_88741t^3$	186·3	35310·4	5276	3907	S
	42·2	26582·7	1587	1175	K
	42·71	27047·1	1542	1142	S
	42·6	27159·2	1565	1159	Z
$1+{\cdot}0_2104139t+{\cdot}0_67836t^2+{\cdot}0_717618t^3$	56·9	23540·1	2417	1790	K
	62·2	28104·1	2213	1639	K
	62·18	28120·1	2211	1637	S
	61·57				P
$1+{\cdot}0_399371t+{\cdot}0_659986t^2+{\cdot}0_712285t^3$	74·4	29585·4	2515	1862	B
	74·2	29593·4	2507	1856	Th
$1+{\cdot}0_39677t+{\cdot}0_520425t+{\cdot}0_819364t^3$	74·10	29585·4	2505	1855	S
	73·9	29585·4	2498	1850	Z
$1+{\cdot}0_2135293t+{\cdot}0_5302426t-{\cdot}0_9290t^3$	77·3	26342·5	2931	2170	K
$1+{\cdot}0_213240t+{\cdot}0_538090t-{\cdot}0_887983t^3$	76·78	26382·5	2910	2155	Th
	77·2	26366·5	2928	2168	Z
	77·08	26342·5	2926	2167	S
	81·28	29633·4	2743	2031	S
$1+{\cdot}0_377430t+{\cdot}0_549689t^2-{\cdot}0_714069t^3$	81·34				P
	81·1	29657·4	2735	2025	Z
$1+{\cdot}0_210326t+{\cdot}0_658810t^2+{\cdot}0_729236t^3$	81·69	28368·3	2880	2133	S
	82·5	28496·4	2895	2144	Z
	84·0	22723·4	3697	2738	D
	101·58	31210·8	3255	2410	S

TABLE LXXI

Name.	Formula.	Boiling Point.	Density at 0°.	Density at Boiling Point.
		117° C.	0·8233	0·7247
Isobutyl alcohol, . .	$C_4H_{10}O$; $(CH_3)_2CH.CH_2OH$	106 ·7		7265
Ethyl ether, . . .	$C_4H_{10}O$; $(C_2H_5)_2O$	34		
		34		6950
		34 ·9	7351	6951
Methyl propyl ether, .	$C_4H_{10}O$; $CH_3.O.C_3H_7$	38 ·9		70415
Valeraldehyde, . .	$C_5H_{10}O$	101		
n-Amyl alcohol, . .	$C_5H_{12}O$; $CH_3.CH_2.CH_2.CH_2.CH_2OH$	137 ·9	8282	7117
Iso-amyl ,, . .	$C_5H_{12}O$; $(CH_3)_2CHCH_2CH_2OH$	135		
		131		7154
Dimethyl ethyl carbinol,	$C_5H_{12}O$; $(CH_3)_2.C(OH).C_2H_5$	101 ·6		7241
Methyl butyl ether, .	$C_5H_{12}O$; $CH_3.O.C_4H_9$	70 ·3	7635	6901
Ethyl propyl ,, .	$C_5H_{12}O$; $C_2H_5.O.C_3H_7$	63 ·6	7545	6871
Phenol, . . .	C_6H_6O ; $C_6H_5.OH$	194	1·0890	
		182 ·9	1·0906	9217
Pinacoline, . . .	$C_6H_{12}O$; $CH_3.CO.C(CH_3)_3$	105		
Allyl ether, . . .	$C_6H_{10}O$; $(C_3H_5)_2O$	94 ·3	0·8223	7217
n-Hexyl alcohol, . .	$C_6H_{14}O$; $C_6H_{13}.OH$	156 ·6	8327	6958
Ethyl butyl ether, .	$C_6H_{14}O$; $C_2H_5.O.C_4H_9$	91 ·4	7680	6875
Methyl isoamyl ether, .	$C_6H_{14}O$; $CH_3.O.C_5H_{11}$(iso)	91		
Propyl ether, . .	$C_6H_{14}O$; $CH_3CH_2.O.CH_2CH_3$	90 ·7	7633	6743
Isopropyl ether, . .	$C_6H_{14}O$; $(CH_3)_2CH.O.CH(CH_3)_2$	68 ·5	7435	6715
Benzaldehyde, . .	C_7H_6O ; C_6H_5COH	179		·
Benzyl alcohol, . .	C_7H_8O ; $C_6H_5.CH_2.OH$	213		
o-Cresol, . . .	C_7H_8O ; $OH.C_6H_4.CH_3(1:2)$	190 ·8	1·0578	8867
m- ,, . . .	C_7H_8O ; $OH.C_6H_4.CH_3.(1:3)$	202 ·8	1·0498	8744
p- ,, . . .	C_7H_8O : $OH.C_6H_4.CH_3(1:4)$	201 ·8	1·0522	8728
Anisol, ...	C_7H_8O ; $CH_3.O.C_6H_5$	155		8608
		154 ·3	1·0110	8604
		155		8607
n-Heptyl alcohol, . .	$C_7H_{16}O$; $C_7H_{15}OH$	175 ·8	0·8342	6876
Propyl butyl ether, .	$C_7H_{16}O$; $C_3H_7.O.C_4H_9$	117 ·1		6638
Phenetol, . . .	$C_8H_{10}O$; $C_2H_5.O.C_6H_5$	172		8196
		170 ·3	9822	8169
o-Tolyl methyl ether, .	$C_8H_{10}O$; $CH_3.O.C_6H_4.CH_3(1:2)$	171 ·3	9957	8331
m- ,, ,, ,, .	$C_8H_{10}O$; $CH_3.O.C_6H_4.CH_3(1:3)$	177 ·2	9891	8225
p- ,, ,, ,, .	$C_8H_{10}O$; $CH_3.O.C_6H_4.CH_3(1:4)$	175 ·0	9868	8241
		175 ·5		
Methyl hexyl ketone, .	$C_8H_{16}O$; $CH_3.CO.C_6H_{13}$	178 ·5		6844
n-Octyl alcohol, . .	$C_8H_{18}O$; $CH_3(CH_2)_7.OH$	195 ·5	8375	6807
Capryl ,, . .	$C_8H_{18}O$; ?	197		6782
Methyl heptyl ether, .	$C_8H_{18}O$; $CH_3.O.C_7H_{15}$	149 ·8	7953	6667
Dibutyl ether, . .	$C_8H_{18}O$; $(C_4H_9)_2O$	140 ·9	7865	6575
Phenyl propyl ether, .	$C_9H_{12}O$; $C_6H_5.O.C_3H_7$	190 ·5	9639	7889
o-Tolyl ethyl ether, .	$C_9H_{12}O$; $C\ H_5.O.C_6H_4.CH_3(1:2)$	184 ·8	9679	7941
m- ,, ,, ,, .	$C_9H_{12}O$; $C\ H_5.O.C_6H_4CH_3(1:3)$	192 ·0	9650	7888
p- ,, ,, ,, .	$C_9H_{12}O$; $C\ H_5.O.C_6H_4CH_3(1:4)$	189 ·9	9662	7884
Methyl octyl ether, .	$C_9H_{20}O$; $CH_3.O.C_8H_{17}$	175	8014	65386
Ethyl heptyl ,, .	$C_9H_{20}O$; $C_2H_5.O.C_7H_{15}$	166 ·6	7949	65065
Thymol, . . .	$C_{10}H_{14}O$; $(CH_3)_2CH.C_6H_3(CH_3).OH$	231 ·8	9941	7923
Carvol, ...	$C_{10}H_{14}O$; $C_3H_7C\left\langle\begin{matrix}CH:CH\\CH:CO\end{matrix}\right\rangle CHCH_3$	227 ·0		7132
Phenyl butyl ether, .	$C_{10}H_{14}O$; $C_6H_5.O.C_4H_9$	210 ·3	9500	7664

—continued.

$V_t = V_o$ multiplied by	Molecular Volume at Boiling Point. Liquid.	Molecular Volume at Boiling Point. Gaseous.	𝔳 at Boiling Point.	v at Boiling Point.	
$1+\cdot0_{3}83751t+\cdot0_{5}28634t^{2}-\cdot0_{8}12415t^{3}$	101·9	31226·8	$0\cdot0_{2}3263$	$0\cdot0_{2}2416$	Z
$1+\cdot0_{2}113958t+\cdot0_{6}51314t^{2}-\cdot0_{10}3104t^{3}$	101·63	30402·1	3343	2475	S
$1+\cdot0_{2}148026t+\cdot0_{5}350316t^{2}+\cdot0_{7}210065t^{3}$	106·1	24581·0	4320	3199	K
	106·2	24581·0	4321	3200	S
	106·1				D
$1+\cdot0_{2}14406t+\cdot0_{6}99286t^{2}+\cdot0_{7}58817t^{3}$	105·1	24973·3	4208	3116	D
	119·9	29945·7	4004	2964	K
$1+\cdot0_{3}91919t-\cdot0_{6}46143t^{2}+\cdot0_{7}17533t^{3}$	123·4	32900·2	3769	2791	Z
	124·4	32668·1	3808	2820	K
	122·7				P
	122·74	32347·8	3794	2809	S
	121·26	29993·7	4043	2994	S
$1+\cdot0_{2}12112t+\cdot0_{5}41791t^{2}+\cdot0_{8}19136t^{3}$	127·2	27487·5	4628	3427	D
$1+\cdot0_{2}13116t+\cdot0_{5}26762t^{2}+\cdot0_{7}15167t^{3}$	127·8	26951·1	4742	3511	D
	103·6	37392·2	2771	2052	K
$1+\cdot0_{3}8340t\ +\cdot0_{6}10732t^{2}+\cdot0_{8}4446t^{3}$	101·8	36503·4	2789	2065	Pt
	138·3	30265·9	4570	3384	S
$1+\cdot0_{2}12519t+\cdot0_{5}22401t^{2}+\cdot0_{8}35775t^{3}$	135·5	29409·2	4607	3411	Z
$1+\cdot0_{3}85539t+\cdot0_{5}12976t^{2}+\cdot0_{7}71314t^{3}$	146·3	34397·6	4253	3149	Z
$1+\cdot0_{2}11062t+\cdot0_{5}57335t^{2}-\cdot0_{7}22011t^{3}$	150·1	29177·0	5144	3809	D
	148·1	29145·0	5081	3762	S
$1+\cdot0_{2}12132t+\cdot0_{5}39318t^{2}-\cdot0_{7}13644t^{3}$	150·9				
$1+\cdot0_{2}12872t+\cdot0_{5}42923t^{2}-\cdot0_{8}58573t^{3}$	151·2	26343·4	5740	4250	Z
$1+\cdot0_{3}9402t\ +\cdot0_{6}82045t^{2}+\cdot0_{8}8060t^{3}$	118·4	36191·1	3272	2423	K
	123·7	38913·5	3179	2354	K
$1+\cdot0_{3}71072t+\cdot0_{5}11464t^{2}+\cdot0_{8}2242t^{3}$	121·5	37136·0	3272	2423	Pt
$1+\cdot0_{3}77526t+\cdot0_{6}27102t^{2}+\cdot0_{8}3868t^{3}$	123·2	38096·8	3234	2395	Pt
$1+\cdot0_{3}86476t-\cdot0_{6}53912t^{2}+\cdot0_{8}35997t^{3}$	123·5	38016·7	3249	2406	Pt
	125·18	34269·4	3653	2705	S
$1+\cdot0_{3}80737t+\cdot0_{5}25718t^{2}-\cdot0_{8}29461t^{3}$	125·2	34213·4	3659	2709	Pt
	125·2	34269·4	3656	2707	S
$1+\cdot0_{3}82994t+\cdot0_{6}24690t^{2}+\cdot0_{7}10979t^{3}$	168·3	35974·9	4678	3464	Z
$1+\cdot0_{2}12603t-\cdot0_{5}15208t^{2}+\cdot0_{7}27552t^{3}$	174·4	31234·8	5584	4134	D
$1+\cdot0_{3}8463t\ +\cdot0_{5}2103t^{2}\ -\cdot0_{9}5443t^{3}$	148·50	35630·6	4168	3086	S
	148·9	35494·5	4195	3106	Pt
$1+\cdot0_{3}82919t+\cdot0_{5}17592t^{2}+\cdot0_{9}29596t^{3}$	146·1	35574·6	4107	3041	Pt
$1+\cdot0_{3}92884t+\cdot0_{6}69012t^{2}+\cdot0_{8}27729t^{3}$	147·5	36047·0	4092	2930	Pt
$1+\cdot0_{3}82558t+\cdot0_{5}16264t^{2}+\cdot0_{9}60197t^{3}$	147·7	35870·8	4118	3049	Pt
	147·8	35910·9	4116	3048	S
	186·64	36151·1	5163	3823	S
$1+\cdot0_{3}78097t+\cdot0_{5}13506t^{2}+\cdot0_{8}35018t^{3}$	190 6	37512·3	5321	3940	Z
	191·29	37632·4	5083	3764	S
$1+\cdot0_{3}97549t+\cdot0_{5}27338t^{2}-\cdot0_{8}42543t^{3}$	194·6	33853·1	5748	4256	D
	197·3	33140·5	5953	4408	D
$1+\cdot0_{3}8415t\ +\cdot0_{5}2188t^{2}\ -\cdot0_{8}2582t^{3}$	172·0	37111·9	4635	3432	Pt
$1+\cdot0_{3}8816t\ +\cdot0_{5}1699t^{2}\ -\cdot0_{9}3432t^{3}$	170·9	36655·5	4662	3452	Pt
$1+\cdot0_{3}92884t+\cdot0_{6}69012t^{2}+\cdot0_{8}27729t^{3}$	172·0	37232·0	4620	3421	Pt
$1+\cdot0_{3}84407t+\cdot0_{5}13305t^{2}+\cdot0_{8}25232t^{3}$	172·1	37063·9	4643	3438	Pt
$1+\cdot0_{2}10046t+\cdot0_{5}10278t^{2}+\cdot0_{8}40918t^{3}$	219·8				D
$1+\cdot0_{3}98742t+\cdot0_{5}16850t^{2}+\cdot0_{8}22351t^{3}$	220·8	35198·3	6273	4645	D
$1+\cdot0_{3}84369t+\cdot0_{6}26625t^{2}+\cdot0_{8}35997t^{3}$	188·9	40418·8	4674	3461	Pt
	190·3	40034·5	4753	3520	S
$1+\cdot0_{3}8807t\ +\cdot0_{5}1146t^{2}\ +\cdot0_{9}4038t^{3}$	195·3	38697·3	5047	3737	Pt

TABLE LXX

Name.	Formula.	Boiling Point.	Density at 0°.	Density at Boiling Point.
o-Tolyl propyl ether, .	$C_{10}H_{14}O$; $C_3H_7.O.C_6H_4.CH_3(1:2)$	204°·1	0·9517	0·7675
m- ,, ,, ,, .	$C_{10}H_{14}O$; $C_3H_7.O.C_6H_4CH_3(1:3)$	210 ·6	9484	7628
p- ,, ,, ,, .	$C_{10}H_{14}O$; $C_3H_7.O.C_6H_4CH_3(1:4)$	210 ·4	9497	7635
Ethyl octyl ether, . .	$C_{10}H_{22}O$; $C_2H_5.O.C_8H_{17}$	189 ·2	8008	6390
Propyl heptyl ether, .	$C_{10}H_{22}O$; $C_3H_7.O.C_7H_{15}$	187 ·6	7987	6420
o-Tolyl butyl ether, .	$C_{11}H_{16}O$; $C_4H_9.O.C_6H_4.CH_3(1:2)$	223 ·0	9437	7493
m- ,, ,, ,, .	$C_{11}H_{16}O$; $C_4H_9.O.C_6H_4CH_3(1:3)$	229 ·2	9407	7422
p- ,, ,, ,,	$C_{11}H_{16}O$; $C_4H_9.O.C_6H_4CH_3(1:4)$	229 ·5	9419	7410
Thymyl methyl ether, .	$C_{11}H_{16}O$; $CH_3.O.C_{10}H_{13}$	216 ·2	9531	7635
Propyl octyl ether, .	$C_{11}H_{24}O$; $C_3H_7.O.C_8H_{17}$	207 ·0	8039	6300
Butyl heptyl ether, .	$C_{11}H_{24}O$; $C_4H_9.O.C_7H_{15}$	205 ·7	8023	6327
Thymyl ethyl ether, .	$C_{12}H_{18}O$; $C_2H_5.O.C_{10}H_{13}$	226 ·9	9334	7400
Butyl octyl ether, . .	$C_{12}H_{26}O$; $C_4H_9.O.C_8H_{17}$	225 ·7	8069	6277
Phenyl heptyl ether, .	$C_{13}H_{20}O$; $C_7H_{15}.O.C_6H_5$	266 ·8	9319	7075
Thymyl propyl ether, .	$C_{13}H_{20}O$; $C_3H_7.O.C_{10}H_{13}$	243 ·0	9276	7215
Phenyl octyl ether, .	$C_{14}H_{22}O$; $C_8H_{17}.O.C_6H_5$	282 ·8	9221	6941
o-Tolyl heptyl ether, .	$C_{14}H_{22}O$; $C_7H_{15}.O.C_6H_4.CH_3(1:2)$	277 ·5	9243	7016
m- ,, ,, ,, .	$C_{14}H_{22}O$; $C_7H_{15}.O.C_6H_4CH_3(1:3)$	283 ·2	9202	6927
p- ,, ,, ,, .	$C_{14}H_{22}O$; $C_7H_{15}.O.C_6H_4CH_3(1:4)$	283 ·3	9228	6905
Thymyl butyl ether, .	$C_{14}H_{22}O$; $C_4H_9.O.C_{10}H_{13}$	258 ·3	9230	7108
Diheptyl ether, . .	$C_{14}H_{30}O$; $(C_7H_{15})_2O$	261 ·9	8152	6055
o-Tolyl octyl ether, .	$C_{15}H_{24}O$; $C_8H_{17}.O.C_6H_4.CH_3\ (1:2)$	292 ·9	9231	6905
m- ,, ,, ,, .	$C_{15}H_{24}O$; $C_8H_{17}.O.C_6H_4.CH_3\ (1:3)$	298 ·9	9194	6818
p- ,, ,, ,, .	$C_{15}H_{24}O$; $C_8H_{17}.O.C_6H_4.CH_3\ (1:4)$	298 ·0	9199	6808
Heptyl octyl ether, .	$C_{15}H_{32}O$; $C_7H_{15}.O.C_8H_{17}$	278 ·8	8182	6038
Di-octyl ether, . .	$C_{16}H_{34}O$; $(C_8H_{17})_2O$	291 ·7	82035	5983
Thymyl heptyl ether, .	$C_{17}H_{28}O$; $(C_7H_{15}).O.C_{10}H_{13}$	306 ·7	9097	6712
,, octyl ether, .	$C_{18}H_{30}O$; $(C_8H_{17}).O.C_{10}H_{13}$	319 ·8	9026	6608
Propylene glycol, . .	$C_3H_8O_2$; $CH_3.CH(OH).CH_2OH$	189	1·0527	8899
Trimethylene glycol, .	$C_3H_8O_2$; $HO.CH_2.CH_2.CH_2\ OH$	214	1·0625	9028
Dimethyl acetal, .	$C_4H_{10}O_2$; $CH_3.CH(OCH_3)_2$	63		8013
Furfurol, . . .	$C_5H_4O_2$	160 ·6		1·0025
Diethyl acetal, . .	$C_6H_{14}O_2$; $CH_3.CH(OC_2H_5)_2$	103 ·2		0·7363
Dimethyl resorcin, .	$C_8H_{10}O_2$; $C_6H_4(OCH_3)_2$	214		
Paraldehyde, . .	$C_6H_{12}O_3$; $(C_2H_4O)_3$	124 ·4		8737
Methylene chloride,	CH_2Cl_2	41 ·6	1·37776	1·30093
Chloroform, . . .	$CHCl_3$	63 ·5		
		61 ·2	1 52657	1·40877
		60 ·9		1·4081
Tetrachlormethane, .	CCl_4	78 ·1		
		76 ·7	1·63195	1·47999
		75 ·7		1·4802
Ethyl chloride, . .	C_2H_5Cl	11		
Ethylene chloride,	$C_2H_4Cl_2$; $CH_2Cl.CH_2Cl$	85		
		83 ·5	1 28082	1·15635
		83 ·3		1·1576
		84 ·1		
Ethylidene chloride, .	$C_2H_4Cl_2$; CH_3CHCl_2	59 ·9	1·20394	1·10923
		56 ·9		1·1142
		57 ·7		
Chlorethylene chloride, .	$C_2H_3Cl_3$; $CH_2Cl.CHCl_2$	115		
		114	1·4577 (9°·4)	1·2945
		113 ·7		
Trichlorethane, .	$C_2H_3Cl_3$; CH_3CCl_3	75		

—continued.

$V_t = V_o$ multiplied by	Molecular Volume at Boiling Point. Liquid.	Molecular Volume at Boiling Point. Gaseous.	$\mathfrak{D}$ at Boiling Point.	$\mathfrak{v}$ at Boiling Point.	
$1+{\cdot}0_3 8629t + {\cdot}0_5 1597t^2 - {\cdot}0_9 3061t^3$	195·0	38200·9	$0{\cdot}0_2 5104$	$0{\cdot}0_2 3779$	Pt
$1+{\cdot}0_3 89092t + {\cdot}0_5 11175t^2 + {\cdot}0_9 6610t^3$	196·2	38721·3	5067	3752	Pt
$1+{\cdot}0_3 8862t + {\cdot}0_5 1116t^2 + {\cdot}0_9 8501t^3$	196·0	38705·3	5064	3750	Pt
$1+{\cdot}0_2 10174t + {\cdot}0_6 38790t^2 + {\cdot}0_8 68984t^3$	246·7	37007·8	6666	4936	D
$1+{\cdot}0_3 97959t + {\cdot}0_5 13456t^2 + {\cdot}0_8 19736t^3$	245·6	36879·7	6657	4929	D
$1+{\cdot}0_3 9251t - {\cdot}0_6 16988t^2 + {\cdot}0_8 55589t^3$	218·4	39714·2	5499	4072	Pt
$1+{\cdot}0_3 89467t + {\cdot}0_6 15807t^2 + {\cdot}0_8 44883t^3$	220·5	40210·6	5484	4061	Pt
$1+{\cdot}0_3 9186t + {\cdot}0_6 1581t^2 + {\cdot}0_8 4332t^3$	220·8	40234·7	5488	4064	Pt
$1+{\cdot}0_3 81994t + {\cdot}0_5 14318t^2 + {\cdot}0_9 40695t^3$	214·3	39169·7	5471	4051	Pt
$1+{\cdot}0_2 10146t + {\cdot}0_7 8290t^2 + {\cdot}0_8 70368t^3$	272·4	38433·1	7088	5249	D
$1+{\cdot}0_3 95585t + {\cdot}0_5 11205t^2 + {\cdot}0_8 27548t^3$	271·3	38329·0	7078	5241	D
$1+{\cdot}0_3 88198t + {\cdot}0_5 10447t^2 + {\cdot}0_9 64014t^3$	240·0	40026·5	5996	4440	Pt
$1+{\cdot}0_3 95981t + {\cdot}0_6 77498t^2 + {\cdot}0_8 25533t^3$	295·7	39930·4	7405	5483	D
$1+{\cdot}0_3 90914t + {\cdot}0_6 31263t^2 + {\cdot}0_8 50946t^3$	270·8	43221·3	6265	4639	Pt
$1+{\cdot}0_3 87204t + {\cdot}0_6 6697t^2 + {\cdot}0_8 23798t^3$	265·5	41315·6	6426	4758	Pt
$1+{\cdot}0_3 83185t + {\cdot}0_6 62366t^2 + {\cdot}0_8 19163t^3$	296·1	44502·4	6654	4927	Pt
$1+{\cdot}0_3 82646t + {\cdot}0_6 58404t^2 + {\cdot}0_8 20023t^3$	292·9	44078·0	6645	4920	Pt
$1+{\cdot}0_3 8430t + {\cdot}0_6 34893t^2 + {\cdot}0_8 27136t^3$	296·7	44534·4	6662	4933	Pt
$1+{\cdot}0_3 89678t - {\cdot}0_6 12175t^2 + {\cdot}0_8 40509t^3$	297·7	44542·4	6684	4949	Pt
$1+{\cdot}0_3 84593t + {\cdot}0_6 51462t^2 + {\cdot}0_8 26463t^3$	289·2	42540·7	6798	5034	Pt
$1+{\cdot}0_3 97709t + {\cdot}0_6 32417t^2 + {\cdot}0_8 62777t^3$	352·7	42838·9	8233	6096	D
$1+{\cdot}0_3 83545t + {\cdot}0_6 48296t^2 + {\cdot}0_8 20178t^3$	317·9	45311·1	7016	5195	Pt
$1+{\cdot}0_3 86187t - {\cdot}0_7 5282t^2 + {\cdot}0_8 35768t^3$	321·9	45791·5	7030	5206	Pt
$1+{\cdot}0_3 88273t + {\cdot}0_6 11834t^2 + {\cdot}0_8 29559t^3$	322·4	45719·5	7052	5222	Pt
$1+{\cdot}0_3 84081t + {\cdot}0_6 79005t^2 + {\cdot}0_8 27293t^3$	376·8	44182·1	8528	6315	D
$1+{\cdot}0_3 87201t + {\cdot}0_6 37044t^2 + {\cdot}0_8 34353t^3$	403·6	45215·0	8926	6610	D
$1+{\cdot}0_3 82073t + {\cdot}0_6 26518t^2 + {\cdot}0_8 27282t^3$	368·7	46416·1	7943	5882	Pt
$1+{\cdot}0_3 74073t + {\cdot}0_5 10460t^2 + {\cdot}0_9 67513t^3$	395·6	47465·0	8835	6542	Pt
$1+{\cdot}0_3 68190t + {\cdot}0_5 10879t^2 + {\cdot}0_8 23439t^3$	85·2	36991·8	2303	1705	Z
$1+{\cdot}0_3 59666t + {\cdot}0_6 25690t^2 + {\cdot}0_8 38324t^3$	84·0	38993·6	2154	1595	Z
	110·81	26903·0	4119	3050	S
	95·53	34717·8	2752	2038	S
	159·90	30121·8	5308	3930	S
	157·1	38993·6	4029	2983	S
	150·74	31819·3	4737	3508	S
$1+{\cdot}0_2 130805t + {\cdot}0_5 2735t^2 - {\cdot}0_8 133t^3$	65·12	25189·5	2584	1913	Th
$1+{\cdot}0_2 123024t + {\cdot}0_5 17138t^2 + {\cdot}0_8 8338t^3$	85·1	26943·0	3159	2339	P
$1+{\cdot}0_2 110715t + {\cdot}0_5 466473t^2 - {\cdot}0_7 174328t^3$	84·53	26758·9	3159	2339	Th
	84·56	26734·9	3163	2342	S
	104·3	28112·1	3710	2747	P
$1+{\cdot}0_2 118384t + {\cdot}0_6 89881t^2 + {\cdot}0_7 135135t^3$	103·68	28000·0	3703	2742	Th
$1+{\cdot}0_2 120719t + {\cdot}0_6 67109t^2 + {\cdot}0_7 13478t^3$	103·66	27919·9	3713	2749	S
$1+{\cdot}0_2 157458t + {\cdot}0_5 281366t^2 + {\cdot}0_7 156987t^3$	71·2	22739·4	3131	2318	P
$1+{\cdot}0_2 111893t + {\cdot}0_5 10469t^2 + {\cdot}0_8 10342t^3$	85·45	28664·5	2981	2207	P
$1+{\cdot}0_2 115303t + {\cdot}0_6 82569t^2 + {\cdot}0_8 9625t^3$	85 34	28544·4	2990	2214	Th
	85·24	28528·4	2988	2213	S
	85·24	28592·5	2981	2207	St
$1+{\cdot}0_2 128402t + {\cdot}0_5 189062t^2 + {\cdot}0_8 7848t^3$	88·96	26654·8	3336	2470	Th
	88·56	26414·6	3353	2483	S
	88 18	26478·6	3330	2466	St
	115·4	31066·6	3715	2752	P
	102·79	30986·6	3317	2456	S
	102·76	30962·6	3319	2458	St
	105·6	27863 8	3790	2807	P

TABLE LXXp.

Name.	Formula.	Boiling Point.	Density at 0°.	Density at Boiling Point.
		74°·1		
Tetrachlorethane (unsym.)	$C_2H_2Cl_4$; $CH_2Cl.CCl_3$	137		
		130·5		
,, (sym.)	$C_2H_2Cl_4$; $CHCl_2.CHCl_2$	146·8		
Pentachlorethane, . .	C_2HCl_5 ; $CHCl_2.CCl_3$	154		
		161·7		
Tetrachlorethylene, .	C_2Cl_4	124		
		121	1·6312(9°·4)	1·4486
Allyl chloride, . .	C_3H_5Cl	45		0·9056
		46	0·9610	9002
Propyl ,, . .	C_3H_7Cl ; $CH_3.CH_2.CH_2Cl$	46		8561
		46·5	9123	8536
Isopropyl chloride, .	C_3H_7Cl ; $(CH_3)_2CH.Cl$	36·5	8825	8326
Propylene ,, . .	$C_3H_6Cl_2$; $CH_3.CHCl.CH_2Cl$	98		
Butyl ,, . .	C_4H_9Cl ; $CH_3.CH_2.CH_2.CH_2Cl$			8094
Isobutyl ,, . .	C_4H_9Cl ; $(CH_3)_2CH.CH_2.Cl$	68		
Butylene ,, . .	$C_4H_8Cl_2$	123		
Isoamyl ,, . .	$C_5H_{11}Cl$; $(CH_3)_2CH.CH_2.CH_2Cl$	99·6		
		101		
		102		
Chlorbenzol, . . .	C_6H_5Cl	132		98175
Chlortoluol, . . .	C_7H_7Cl ; $C_6H_4Cl.CH_3$	160		9351
Benzyl chloride, . .	C_7H_7Cl ; $C_6H_5.CH_2Cl$	203·5		
Acetyl ,, . .	C_2H_3OCl ; CH_3COCl	55		
		50·7	1·13773	1·05698
Chloral, ...	C_2HCl_3O ; $CCl_3.CHO$	99		
Trichloracetyl chloride, .	C_2Cl_4O ; $CCl_3.CClO$	118	1·65640	1·44517
Epichlorhydrin, . .	C_3H_5OCl ; $\underbrace{CH_2.CH}_{O}.CH_2Cl$	116·6	1·20313	1·05667
		115·9		
Benzoyl chloride, . .	C_7H_5ClO ; $C_6H_5.CO.Cl$	198		
Methyl bromide, . .	CH_3Br	13		
Bromoform, . . .	$CHBr_3$	151·2	2·83413	2·43611
Trichlorbrom-methane, .	CCl_3Br	104·1	2·05496	1·82446
Ethyl bromide, . .	C_2H_5Br	40·7		
		38·4		
Chlorobrom-ethane, .	C_2H_4ClBr ; $CH_2Cl.CH_2Br$	109		
Ethylene bromide, .	$C_2H_4Br_2$; $CH_2Br.CH_2Br$	133		
		131·5	2·21324	1·93124
		130		
Allyl bromide, . .	C_3H_5Br ; $CH_2 : CH.CH_2Br$	71	1·4593	1·3333
Dibromethylene, . .	$C_2H_2Br_2$; $CHBr : CHBr$	109·4	2·2983	2·0352
Propyl bromide, . .	C_3H_7Br ; $CH_3CH_2CH_2Br$	71	1·3835	1·2639
Isopropyl ,, . .	C_3H_7Br ; $(CH_3)_2CH.Br$	60	1·3397	1·2368
Propylene ,, . .	$C_3H_6Br_2$; $CH_3CHBr.CH_2Br$	141·7	1·9617	1·6944
Trimethylene bromide, .	$C_3H_6Br_2$; $CH_2Br.CH_2.CH_2Br$	165	2·0060	1·7101
Isobutyl bromide, . .	C_4H_9Br	91		
Amyl ,, . .	$C_5H_{11}Br$			1·0502
Isoamyl ,, . .	$C_5H_{11}Br$	119		
		118·5		
Brombenzol, . .	C_6H_5Br	155·6	1·5203	1·3080
		156		
o-Bromtoluol, . .	C_7H_7Br ; $C_6H_4Br.CH_3$	182		
Methyl iodide, . .	CH_3I	40		
		42·8	2·3346	2·2146

—continued.

$V_t = V_o$ multiplied by	Molecular Volume at Boiling Point. Liquid.	Molecular Volume at Boiling Point. Gaseous.	𝔟 at Boiling Point.	𝔳 at Boiling Point.	
	107·98	27791·8	$0{\cdot}0_2 3885$	$0{\cdot}0_2 2877$	St
	121·4	32828·2	3698	2738	P
	121·52	32207·7	3773	2795	St
	119·23	33612·9	3547	2626	St
	143·0	34189·4	4183	3097	P
	138·15	34805·9	3969	2939	St
	115·4	31787·3	3630	2688	P
	114·21	31547·1	3620	2681	S
	84·22	25461·7	3308	2450	S
$1 + {\cdot}0_2 13218t + {\cdot}0_5 50781t^2 - {\cdot}0_7 41915t^3$	84·7	25541·8	3316	2455	Z
	91·35	25541·8	3576	2648	P
$1 + {\cdot}0_2 13306t + {\cdot}0_5 38313t^2 - {\cdot}0_7 13859t^3$	91·7	25581·9	3573	2646	Z
$1 + {\cdot}0_2 13696t + {\cdot}0_5 55827t^2$	93·6	24781·3	3777	2798	Z
	107·6	29705·5	3622	2682	
	114				St
	114·3	27303·4	4186	3110	S
	129·5	31707·2	4084	3024	K
	134·4	29833·6	4505	3336	S
	137	29945·7	4575	3388	K
	135·4	30025·7	4509	3339	P
	114·28	32427·8	3524	2609	S
	134·91	34669·8	3862	2860	S
	154·3	38152·9	4044	2994	S
	75·2	26262·4	2863	2120	K
$1 + {\cdot}0_2 136948t + {\cdot}0_5 207390t^2 + {\cdot}0_7 12185t^3$	74·05	25118·1	2948	2183	Th
$1 + {\cdot}0_3 9545t - {\cdot}0_6 22139t^2 + {\cdot}0_7 56392t^3$	108·9	29785·5	3656	2707	K
$1 + {\cdot}0_2 109113t + {\cdot}0_6 27205t^2 + {\cdot}0_8 8293$	125·51	31306·9	4009	2969	Th
$1 + {\cdot}0_2 10266t + {\cdot}0_6 61974t^2 + {\cdot}0_8 6657t^3$	87·29	31194·8	2798	2072	Th
	87·11	31138·7	2797	2071	S
	137·8	37712·5	3654	2706	K
$1 + {\cdot}0_2 141521t + {\cdot}0_5 331528t^2 + {\cdot}0_6 113809t^3$	58·2	22899·5	2542	1882	P
$1 + {\cdot}0_3 94116t + {\cdot}0_6 27800t^2 + {\cdot}0_8 4259t^3$	103·53	33965·2	3048	2257	Th
$1 + {\cdot}0_2 108231t + {\cdot}0_6 65582t^2 + {\cdot}0_8 58582t^3$	108·43	30193·9	3591	2659	Th
$1 + {\cdot}0_2 133763t + {\cdot}0_5 150135t^2 + {\cdot}0_7 169t^3$	78·4	25117·4	3121	2311	P
	77·1	24933·3	3092	2290	S
	88·01	30586·2	2877	2130	St
	97·5	32507·9	2999	2221	P
$1 + {\cdot}0_2 95285t + {\cdot}0_6 68346t^2 + {\cdot}0_8 3947t^3$	97·08	32387·8	2997	2219	Th
	97·65	32267·7	3026	2241	S
$1 + {\cdot}0_2 12275t - {\cdot}0_6 44365t^2 + {\cdot}0_7 25843t^3$	90·5	27543·6	3286	2433	Z
$1 + {\cdot}0_3 99103t + {\cdot}0_5 17519t^2 + {\cdot}0_8 1177t^3$	91·11	30618·3	2976	2204	W
$1 + {\cdot}0_2 12239t + {\cdot}0_6 56696t^2 + {\cdot}0_7 13690t^3$	97·2	27543·6	3529	2613	Z
$1 + {\cdot}0_2 12494t + {\cdot}0_5 18870t^2 + {\cdot}0_8 63651t^3$	99·2	26662·8	3721	2740	Z
$1 + {\cdot}0_3 91672t + {\cdot}0_5 12277t^2 + {\cdot}0_8 12010t^3$	118·4	33204·5	3566	2641	Z
$1 + {\cdot}0_3 81968t + {\cdot}0_5 24944t^2 - {\cdot}0_8 67159t^3$	117·1	35070·1	3339	2472	Z
	110·4	29145·0	3788	2805	S
	143·8				St
	149·2	31386·9	4754	3520	P.
	138·6	31346·9	4423	3275	S
$1 + 0{\cdot}0_3 83368t + {\cdot}0_6 90506t^2 + {\cdot}0_8 28245t^3$	119·70	34175	3503	2594	W
	119·9	34349·5	3491	2585	S
	115·0	36431·3	3157	2338	S
	68·3	29865·6	2287	1693	P
$1 + {\cdot}0_2 11440t + {\cdot}0_5 40465t^2 - {\cdot}0_7 27393t^3$	63·9	25285·6	2527	1871	D

TABLE LXXP.

Name.	Formula.	Boiling Point.	Density at 0°.	Density at Boiling Point.
Ethyl iodide, . .	C_2H_5I	70		
		72·5	1·9795	1·8156
		72·2		
Allyl ,, . .	C_3H_5I ; $CH_2 : CH.CH_2I$	103	1·8696	1·6601
Propyl ,, . .	C_3H_7I ; $CH_3.CH_2.CH_2I$	102·5	1·7863	
		102·5	1·7829	1·585
Isopropyl iodide, . .	C_3H_7I ; $(CH_3)_2CHI$	93	1·7504	
		89	1·7440	
Butyl iodide, . .	C_4H_9I ; $CH_3.CH_2.CH_2.CH_2I$	129·9	1·6476	1·4308
Isobutyl ,, . .	C_4H_9I ; $(CH_3)_2CH.CH_2I$	120		
n-Amyl ,, . .	$C_5H_{11}I$; $CH_3.(CH_2)_3.CH_2I$	151·7	1·5444	1·3128
Isoamyl ,, . .	$C_5H_{11}I$; $(CH_3)_2.CH.CH_2.CH_2I$	148		
		148		
Iodobenzol, . . .	C_6H_5I	188		
Hexyl iodide, . .	$C_6H_{13}I$	177·1	1·4661	1·2165
Heptyl ,, . .	$C_7H_{15}I$	203·8	1·4008	1·1344
Octyl ,, . .	$C_8H_{17}I$	225·5	1·3533	1·075
Formic acid, . .	CH_2O_2 ; $HCOOH$	99		
		101	1·2415	1·1175
		100·3		
Acetic ,, . . .	$C_2H_4O_2$; CH_3COOH	118		0·
		118·1	1·0701	9372
Methyl formate, .	$C_2H_4O_2$; $HCOOCH_3$	36	0·99839	
		32·4		
		32·3	0·99839	95196
Propionic acid, . .	$C_3H_6O_2$; C_2H_5COOH	137		
		140·7	1·0199	8657
		140·9	1·0133	8599
Methyl acetate, . .	$C_3H_6O_2$; CH_3COOCH_3	55		
		55		
		57·5	0·95774	88086
		57·3	9643	8873
Ethyl formate, . .	$C_3H_6O_2$; $HCOOC_2H_5$	55	9447	
		53·5	9431	
		54·4	93757	86667
		55	9445	8725
Methyl acrylate, . .	$C_4H_6O_2$; $CH_2 : CH.COOCH_3$	80·3	97388	87194
Butyric acid, . .	$C_4H_8O_2$; $CH_3CH_2CH_2COOH$	156		
		162		
		162·3	9746	8099
Isobutyric acid, . .	$C_4H_8O_2$; $(CH_3)_2CH.COOH$	153		
		154	9651	8054
Methyl propionate, .	$C_4H_8O_2$; $C_2H_5COOCH_3$	79	9420	
		79·9	93725	836798
		79·5	9403	8393
Ethyl acetate, . .	$C_4H_8O_2$; $CH_3COOC_2H_5$	74		
		76		
		77·1	92388	82673
		77·5	9253	8272
Propyl formate, . .	$C_4H_8O_2$; $HCOOC_3H_7$	83		
		81	91838	82146
		81	9250	8270
Ethyl acrylate, . .	$C_5H_8O_2$; $CH_2 : CH.COOC_2H_5$	98·5	93928	81970

—*continued.*

$V_t = V_o$ multiplied by	Molecular Volume at Boiling Point. Liquid.	Molecular Volume at Boiling Point. Gaseous.	𝔟 at Boiling Point.	𝔳 at Boiling Point.	
	86·1	27463·5	$0·0_{2}3135$	$0·0_{2}2321$	P
$1+·0_{2}11520t+·0_{6}26032t^2+·0_{7}14181t^3$	85 6	27663·7	3097	2293	D
	86·1	27639·7	3115	2307	S
$1+·0_{2}10539t+·0_{6}63572t^2+·0_{7}10036t^3$	100·9	30105·8	3352	2482	Z
	106·9	30065·8	3556	2633	Z
$1+·0_{2}10276t+·0_{5}18658t^2-·0_{10}508t^3$	106·9	30065·8	3556	2633	D
	108·4	29305·1	3699	2739	B
	108·4	28984·8	3740	2769	Z
$1+·0_{3}96069t+·0_{5}22362t^2-·0_{8}50289t^3$	128·2	32259·7	3974	2943	D
	151·1	31467·0	4802	3556	S
$1+·0_{3}92658t+·0_{5}14647t^2-·0_{9}59616t^3$	150·4	34005·2	4423	3275	D
	158·8	33709·0	4711	3488	K
	151·1	33709·0	4482	3319	S
	130·6	36911·8	3538	2620	S
$1+·0_{3}94874t+·0_{6}32484t^2+·0_{8}48625t^3$	173·8	36039·0	4823	3571	D
$1+·0_{3}91069t+·0_{6}20442t^2+·0_{8}4794t^3$	198·6	38176·9	5202	3852	D
$1+·0_{3}88271t+·0_{6}31536t^2+·0_{8}3813t^3$	222·6	39914·4	5577	4130	D
	41·8	29785·5	1403	1037	K
$1+·0_{3}95790t+·0_{6}9647t^2+·0_{8}45729t^3$	41·07	29945·7	1371	1015	Z
	41·08	29889·6	1374	1017	S
	63·5	31306·9	2028	1503	K
$1+·0_{2}10630t-·0_{6}12636t^2+·0_{7}10876t^3$	63·8	31314·9	2037	1508	Z
	63·4	24741·1	2563	1898	K
	62·57	24452·9	2559	1895	S
$1+·0_{2}135824t+·0_{4}10538t^2-·0_{6}18085t^3$	62·84	24444·9	2571	1904	E
	85·4	32828·2	2601	1926	K
	85·3	33124·4	2575	1907	Z
$1+·0_{2}10396t+·0_{5}15487t^2+·0_{9}4301t^3$	85·9	33140·5	2592	1919	Z
	83·7	26262·4	3187	2360	K
	83·66	26262·4	3186	2359	S
$1+·0_{2}134982t+·0_{6}87098t^2+·0_{7}35562t^3$	83·77	26462·6	3166	2344	E
$1+·0_{2}12785t+·0_{5}49742t^2-·0_{7}14974t^3$	83·2	26446·6	3146	2330	G
$1+·0_{2}136446t+·0_{6}13538t^2+·0_{7}39248t^3$	84 9	26262·4	3233	2394	K
	84·54	26142·4	3234	2395	S
$1+·0_{2}130917t+·0_{5}19198t^2+·0_{7}30497t^3$	85·14	26214 4	3248	2405	E
	84·6	26262·4	3221	2385	G
$1+·0_{2}13589t-·0_{5}13342t^2+·0_{7}31235t^3$	98·4	28288·2	3478	2575	W
	106·6	34349·5	3103	2298	K
$1+·0_{2}102573t+·0_{6}83760t^2+·0_{8}34694t^3$	107·7				P
	107·85	34829·9	3096	2292	S
$1+·0_{2}10296t+·0_{6}83104t^2+·0_{8}35905t^3$	108·2	34853·9	3104	2298	Z
	108·57	34109·3	3183	2357	S
$1+·0_{3}97625t+·0_{5}23976t^2-·0_{8}32145t^3$	108·9	34189·4	3185	2358	Z
	104·24	28184·1	3686	2728	S
$1+·0_{2}130490t-·0_{5}13275t^2+·0_{7}46943t^3$	104·86	28256·2	3711	2748	E
	104·6	28224·2	3706	2744	G
$1+·0_{2}12738t+·0_{5}21914t^2+·0_{7}11797t^3$	107·4	27783·8	3866	2863	K
	105·70	27943·9	3783	2801	S
$1+·0_{2}121850t+·0_{6}45587t^2-·0_{8}76926t^3$	106·15	28032·0	3786	2803	E
$1+·0_{2}13463t+·0_{6}4027t^2+·0_{7}25097t^3$	106·10	28064·0	3781	2800	G
	108·73	28504·4	3814	2824	S
$1+·0_{2}119030t+·0_{5}201033t^2+·0_{7}15776t^3$	106·83	28344·3	3769	2791	E
	106·0	28344 3	3740	2769	G
$1+·0_{2}12414t+·0_{6}77929t^2+·0_{7}1671t^3$	121·7	29745·5	4091	3029	W

TABLE LXXF

Name.	Formula.	Boiling Point.	Density at 0°.	Density at Boiling Point.
Allyl acetate, . .	$C_5H_8O_2$; $CH_3COOC_3H_5$	104°		
Valeric acid, . . .	$C_5H_{10}O_2$; $CH_3(CH_2)_3.COOH$	185 ·4	0·9562	0·7828
Isovaleric acid, . .	$C_5H_{10}O_2$; $(CH_3)_2CH.CH_2COOH$	175		
Methyl butyrate, . .	$C_5H_{10}O_2$; $CH_3CH_2CH_2.COOCH_3$	93		
		102		
		102 ·3	91939	80261
		102 ·3	9194	8026
,, isobutyrate, .	$C_5H_{10}O_2$; $(CH_3)_2CH.COOCH_3$	92 ·4		
		92 ·3	911181	80397
Ethyl propionate, . .	$C_5H_{10}O_2$; $C_2H_5COOC_2H_5$	98 ·8		7962
		98 ·3	91238	79868
		98 ·3	91224	7947
		98 ·8	9114	7970
Propyl acetate, . .	$C_5H_{10}O_2$; $CH_3COOC_3H_7$			
		102		
		100 ·8	9093	7934
		100 ·8	909092	794388
Butyl formate, . .	$C_5H_{10}O_2$; $HCOOCH_2CH_2CH_2CH_3$	99		
		106 ·9	9108	7972
Isobutyl formate, . .	$C_5H_{10}O_2$; $HCOOCH_2CH(CH_3)_2$	97 ·9	88543	78287
Propyl acrylate, . .	$C_6H_{10}O_2$; $CH_2 : CH.COOC_3H_7$	122 ·9	91996	7847
Caproic acid, . .	$C_6H_{12}O_2$; $C_5H_{11}COOH$	205	9446	7589
Methyl valerate, . .	$C_6H_{12}O_2$; $CH_3(CH_2)_3COOCH_3$	127 ·3	9097	7767
,, isovalerate, .	$C_6H_{12}O_2$; $(CH_3)_2CH.CH_2COOCH_3$	112		
		116		
		116 ·7	90065	77518
Ethyl butyrate, . .	$C_6H_{12}O_2$; $CH_3(CH_2)_2COOC_2H_5$	112		
		120		
		119 ·9	89957	76940
		120 ·9	9004	7689
,, isobutyrate, .	$C_6H_{12}O_2$; $(CH_3)_2CH.COOC_2H_5$			
		110 ·1		
		110 ·1	890367	77725
Propyl propionate, .	$C_6H_{12}O_2$; $C_2H_5COOC_3H_7$			
		122		
		122 ·2	90192	772008
		122 ·6	9023	7719
Butyl acetate, . .	$C_6H_{12}O_2$; $CH_3COO.CH_2CH_2CH_2CH_3$	113		
		124 ·5	9016	7683
Isobutyl ,, . .	$C_6H_{12}O_2$; $CH_3COO.CH_2CH(CH_3)_2$	116 ·3	892100	77080
Amyl formate, . .	$C_6H_{12}O_2$; $HCOO.(CH_2)_4CH_3$	130 ·4	9018	7692
Isoamyl ,, . .	$C_6H_{12}O_2$; $HCOO.(CH_2)_2CH(CH_3)_2$	112		
		124		
		123 ·3	894378	77027
Benzoic acid, . .	$C_7H_6O_2$; C_6H_5COOH	253		
Heptylic ,, . .	$C_7H_{14}O_2$; $C_6H_{13}COOH$	223	9313	7429
Methyl caproate, . .	$C_7H_{14}O_2$; $C_5H_{11}COOCH_3$	149 ·6	9039	7536
Ethyl valerate, . .	$C_7H_{14}O_2$; n-$C_4H_9COOC_2H_5$	144 ·7	8939	7443
,, isovalerate, . .	$C_7H_{14}O_2$; i-$C_4H_9COOC_2H_5$	131		
		134		
		134 ·3	88514	74764
Propyl butyrate, . .	$C_7H_{14}O_2$; $CH_3CH_2CH_2.COOC_3H_7$	144		
		142 ·7	89299(9°)	745694

—*continued.*

$V_t = V_o$ multiplied by	Molecular Volume at Boiling Point. Liquid.	Molecular Volume at Boiling Point. Gaseous.	𝔟 at Boiling Point.	𝔳 at Boiling Point.	
	121·4	30185·9	$0{\cdot}0_2 4022$	$0{\cdot}0_2 2978$	S
$1+{\cdot}0_3 977557t+{\cdot}0_6 61852t^2+{\cdot}0_8 30378t^3$	130·0	36703·6	3542	2623	Z
	130·3	35870·8	3632	2688	K
	127·3	29305·1	4344	3217	K
	126·35	30025·7	4208	3116	S
$1+{\cdot}0_2 113062t-{\cdot}0_5 24809t^2+{\cdot}0_8 3623t^3$	126·75	30049·8	4218	3123	E
	126·7	30049·8	4216	3122	G
	126·43	29329·1	4311	3192	G
$1+{\cdot}0_2 12170t+{\cdot}0_6 38334t^2+\ 0_7 22582t^3$	126·54	29249·1	4326	3203	E
	127·83	29745·5	4297	3182	S
$1+{\cdot}0_2 119971t+{\cdot}0_5 14867t^2+{\cdot}0_7 10599t^3$	127·37	29729·5	4284	3172	E
	128·06	29729·5	4308	3190	W
	127·7	29745·5	4293	3179	G
	108·8				P
	128·56	30025·7	4282	3171	S
	128·4	29929·7	4290	3177	G
$1+{\cdot}0_2 119136t+{\cdot}0_6 41636t^2+{\cdot}0_7 195994t^3$	128·06	30009·7	4267	3160	E
	130·74	29785·5	4389	3250	S
$1+{\cdot}0_2 10982t+{\cdot}0_5 16213t^2+{\cdot}0_8 53409t^3$	127·6	30418·1	4195	3106	G
$1+{\cdot}0_2 110259t+{\cdot}0_6 16354t^2+{\cdot}0_9 7877t^3$	129·95	29697·4	4376	3240	E
$1+{\cdot}0_2 11584t+{\cdot}0_5 11860t^2+{\cdot}0_8 65399t^3$	144·95	31699·2	4573	3386	W
$1+{\cdot}0_3 94413t+{\cdot}0_6 68358t^2+{\cdot}0_8 26586t^3$	152·5	38272·9	3985	2951	Z
$1+{\cdot}0_2 10342t+{\cdot}0_5 27519t^2+{\cdot}0_8 23923t^3$	149·1	32051·5	4652	3445	G
	148·7	30826·4	4824	3572	K
	148·3	31146·7	4761	3525	S
$1+{\cdot}0_2 117586t-{\cdot}0_5 40968t^2+{\cdot}0_7 19006t^3$	149·6	31202·8	4794	3550	E
	149·1	30826·4	4837	3582	K
	150·3				P
	150·3	31467·0	4776	3537	S
$1+{\cdot}0_2 115209t+{\cdot}0_6 88691t^2+{\cdot}0_7 10611t^3$	150·4	31459·0	4781	3540	E
	150·5	31539·1	4772	3534	G
	151·7				P
	150·7	35478·5	4248	3146	S
$1+{\cdot}0_2 11245t+{\cdot}0_5 33052t^2+{\cdot}0_7 13733t^3$	148·86	35478·5	4141	3066	E
	151·6				P
	150·6	31627·1	4762	3526	S
$1+{\cdot}0_2 102553t+{\cdot}0_5 27380t^2+{\cdot}0_8 11359t^3$	149 9	31643·1	4737	3508	E
	149·9	31675·2	4732	3504	G
	152·5	30906·5	4611	3414	S
$1+{\cdot}0_2 11065t+{\cdot}0_5 20350t^2+{\cdot}0_8 2110t^3$	150·6	31827·3	4732	3504	G
$1+{\cdot}0_2 111560t+{\cdot}0_5 21729t^2-{\cdot}0_8 11275t^3$	150·1	31170·7	4815	3565	E
$1+{\cdot}0_2 10583t+{\cdot}0_5 16498t^2+{\cdot}0_8 28471t^3$	150·5	32299·7	4659	3450	G
	150·2	30826·4	4872	3608	K
	153·2	31787·3	4820	3569	S
$1+{\cdot}0_2 105857t+{\cdot}0_6 74296t^2+{\cdot}0_7 11219t^3$	150·2	31731·2	4734	3505	E
	126·9	42116·3	3013	2231	K
$1+{\cdot}0_3 85249t+{\cdot}0_5 13435t^2-{\cdot}0_9 33400t^3$	174·6	39714·2	4396	3255	Z
$1+{\cdot}0_2 10376t+{\cdot}0_5 12634t^2+{\cdot}0_8 47593t^3$	172·2	33837·1	5089	3768	G
$1+{\cdot}0_2 11059t+{\cdot}0_6 6495t^2+{\cdot}0_8 90414t^3$	174·5	33444·7	5218	3864	G
	173·5	32347·8	5364	3972	K
	173·0	32588·0	5309	3931	S
$1+{\cdot}0_2 101427t+{\cdot}0_5 19712t^2+{\cdot}0_8 50117t^3$	173 4	32612·0	5317	3937	E
	173·9	33388·7	5208	3856	S
$1+{\cdot}0_2 105831t+{\cdot}0_5 18646t^2+{\cdot}0_7 29383t^3$	173·9	33244·6	5231	3873	E

TABLE LXX

Name.	Formula.	Boiling Point.	Density at 0°.	Density at Boiling Point.
		143°·2	0·8929	0·7445
Propyl isobutyrate, .	$C_7H_{14}O_2$; $(CH_3)_2CHCOOC_3H_7$	135		
		133 ·9	884317	74647
Butyl propionate, . .	$C_7H_{14}O_2$; $C_2H_5COO(CH_2)_3CH_3$	145 ·4	8953	7489
Isobutyl ,, . .	$C_7H_{14}O_2$; $C_2H_5COOCH_2CH(CH_3)_2$	137		
		136 ·8	887595	74424
Amyl acetate, . .	$C_7H_{14}O_2$; $CH_3COOC_5H_{11}(n)$	147 ·6	8948	7461
Isoamyl ,, . .	$C_7H_{14}O_2$; $CH_3COOC_5H_{11}(i)$	131		
		139		
Hexyl formate, . .	$C_7H_{14}O_2$; $HCOOC_6H_{13}$	153 ·6	8977	7484
Methyl benzoate, . .	$C_8H_8O_2$; $C_6H_5COOCH_3$	190		
Octylic acid, . . .	$C_8H_{16}O_2$; $C_7H_{15}COOH$	236	9270	7264
Methyl heptylate, . .	$C_8H_{16}O_2$; $C_6H_{13}COOCH_3$	172 ·1	9333	7325
Ethyl caproate, . .	$C_8H_{16}O_2$; $C_5H_{11}COOC_2H_5$	166 ·6	8888	7269
Propyl valerate, . .	$C_8H_{16}O_2$; $n\text{-}C_4H_9.COOC_3H_7$	167 ·5	8888	7264
,, isovalerate,. .	$C_8H_{16}O_2$; $i\text{-}C_4H_9COOC_3H_7$	156		
		156	880915	727405
Butyl butyrate, . .	$C_8H_{16}O_2$; $C_3H_7COOC_4H_9$	165 ·7	8878	7264
Isobutyl ,, . .	$C_8H_{16}O_2$; $C_3H_7COOC_4H_9(i)$	158		
		156 ·9	881778	71630
,, isobutyrate, .	$C_8H_{16}O_2$; $i\text{-}C_3H_7COOC_4H_9(i)$	149		
		146 ·6	874957	73281
Isoamyl propionate, .	$C_8H_{16}O_2$; $C_2H_5COOC_5H_{11}(i)$	161		
		160 ·2	887672	73646
Hexyl acetate, . .	$C_8H_{16}O_2$; $CH_3COOC_6H_{13}$	169 ·2	8902	7267
Heptyl formate, . .	$C_8H_{16}O_2$; $H.COOC_7H_{15}$	175 ·5	8937	7308
Cinnamic acid, . .	$C_9H_8O_2 ; \left\{\begin{matrix} HC.C_6H_5 \\ HC.COOH \end{matrix}\right.$	300	1·0562	90974
Ethyl benzoate, . .	$C_9H_{10}O_2$; $C_6H_5COOC_2H_5$	209		
Phenyl-propionic acid, .	$C_9H_{10}O_2$; $C_6H_5CH_2CH_2COOH$	279 ·8	1·07115(48°·7)	8780
Methyl octylate, . .	$C_9H_{18}O_2$; $C_7H_{15}COOCH_3$	192 ·9	0·8942	7163
Ethyl heptylate, . .	$C_6H_{18}O_2$; $C_6H_{13}COOC_2H_5$	187 ·1	8861	7105
Propyl caproate, . .	$C_9H_{18}O_2$; $C_5H_{11}COOC_3H_7$	185 ·5	8844	7097
Butyl valerate, . .	$C_9H_{18}O_2$; $C_4H_9COOC_4H_9$	185 ·8	8847	7095
Isobutyl isovalerate, .	$C_9H_{18}O_2$; $i\text{-}C_4H_9COOC_4H_9(i)$	168 ·7	873599	70549
Amyl butyrate, . .	$C_9H_{18}O_2$; $C_3H_7COOC_5H_{11}$	184 ·8	8832	7092
Isoamyl butyrate, .	$C_9H_{18}O_2$; $C_3H_7COOC_5H_{11}(i)$	178 ·6	882306	71148
,, isobutyrate .	$C_9H_{18}O_2$; $iC_3H_7COOC_5H_{11}(i)$	168 ·8	875965	70662
Heptyl acetate, . .	$C_9H_{18}O_2$; $CH_3COOC_7H_{15}$	191 ·3	8891	7134
Octyl formate, . .	$C_9H_{18}O_2$; $HCOOC_8H_{17}$	198 ·1	8929	7156
Methyl cinnamate, .	$C_{10}H_{10}O_2$; $CH(C_6H_5) : CH.COOCH_3$	259 ·6	1·0415 (36°)	85888
,, phenylpropionate,	$C_{10}H_{12}O_2$; $C_6H_5CH_2CH_2COOCH_3$	236 ·6	1·0473	83824
,, nonylate, . .	$C_{10}H_{20}O_2$; $C_8H_{17}COOCH_3$	213 ·5	0·8918	7024
Ethyl octylate, . .	$C_{10}H_{20}O_2$; $C_7H_{15}COOC_2H_5$	205 ·8	8842	6980
Propyl heptylate, . .	$C_{10}H_{20}O_2$; $C_6H_{13}COOC_3H_7$	206 ·4	8824	6965
Butyl caproate, . .	$C_{10}H_{20}O_2$; $C_5H_{11}COOC_4H_9$	204 ·3	8824	6978
Amyl valerate, . .	$C_{10}H_{20}O_2$; $C_4H_9COOC_5H_{11}$	203 ·7	8812	6982
Isoamyl isovalerate, .	$C_{10}H_{20}O_2$; $iC_4H_9COOC_5H_{11}(i)$	188		
Hexyl butyrate, . .	$C_{10}H_{20}O_2$; $C_3H_7COOC_6H_{13}$	205 ·1	8825	6963
Heptyl propionate, .	$C_{10}H_{20}O_2$; $C_2H_5COOC_7H_{15}$	208 ·0	8846	6946
Octyl acetate, . .	$C_{10}H_{20}O_2$; $CH_3COOC_8H_{17}$	210	8847	6981
Ethyl cinnamate, . .	$C_{11}H_{12}O_2$; $CH(C_6H_5) : CHCOOC_2H_5$	271	1·0653	82143

—continued.

$V_t=V_o$ multiplied by	Molecular Volume at Boiling Point. Liquid.	Molecular Volume at Boiling Point. Gaseous.	$\mathfrak{b}$ at Boiling-Point.	$\mathfrak{v}$ at Boiling-Point.	
	174·				G
	174·2	32668·0	$0{\cdot}0_{2}5332$	$0{\cdot}0_{2}3948$	S
$1+{\cdot}0_{2}101579t+{\cdot}0_{5}227158t^2+{\cdot}0_{8}32959t^3$	173·7	32580·0	5331	3947	E
$1+{\cdot}0_{2}10380t+{\cdot}0_{5}25870t^2-{\cdot}0_{8}32960t^3$	173·2	33500·8	5170	3828	G
	173·5	32828·2	5285	3913	S
$1+{\cdot}0_{3}98693t+{\cdot}0_{5}28451t^2-{\cdot}0_{8}17023t^3$	174·2	32812·2	5309	3931	E
$1+{\cdot}0_{2}10378t+{\cdot}0_{5}19036t^2+{\cdot}0_{8}14289t^3$	173·8	33676·9	5161	3822	G
	173·3	32347·8	5357	3967	K
	174·6	32988·3	5293	3919	S
$1+{\cdot}0_{2}10511t+{\cdot}0_{6}10118t^2+{\cdot}0_{8}39025t^3$	173·3	34157·4	5074	3757	G
	150·3	37071·9	4054	3002	K
$1+{\cdot}0_{3}92169t+{\cdot}0_{6}14790t^2+{\cdot}0_{8}37676t^3$	197·8	40755·1	4853	3594	Z
$1+{\cdot}0_{2}10200t+{\cdot}0_{6}6927t^2+{\cdot}0_{8}57461t^3$	196·2	35638·6	5505	4076	G
$1+{\cdot}0_{2}10093t+{\cdot}0_{5}16863t^2+{\cdot}0_{8}16835t^3$	197·7	35198·2	5617	4159	G
$1+{\cdot}0_{2}10456t+{\cdot}0_{5}11684t^2+{\cdot}0_{8}33104t^3$	197·8	35270·3	5608	4153	G
	196·8	34349·5	5729	4242	S
$1+{\cdot}0_{3}98240t+{\cdot}0_{5}13670t^2+{\cdot}0_{8}65074t^3$	197·5	34349·5	5753	4260	E
$1+{\cdot}0_{2}10402t+{\cdot}0_{5}12306t^2+{\cdot}0_{8}35228t^3$	197·8	35126·2	5631	4170	G
	197·7	34509·7	5729	4242	S
$1+{\cdot}0_{2}108188t+{\cdot}0_{5}11705t^2+{\cdot}0_{8}84011t^3$	200·5	34661·8	5784	4283	E
	198·2	33789·0	5866	4344	S
$1+{\cdot}0_{3}96746t+{\cdot}0_{5}26672t^2+{\cdot}0_{8}22774t^3$	196·0	33596·9	5846	4329	E
	196·9	34749·9	5666	4196	S
$1+{\cdot}0_{3}96956t+{\cdot}0_{5}18674t^2+{\cdot}0_{9}6116t^3$	195·0	34685·8	5622	4163	E
$1+{\cdot}0_{3}9864t+{\cdot}0_{5}16332t^2+{\cdot}0_{8}23310t^3$	197·7	35406·4	5584	4135	G
$1+{\cdot}0_{3}96196t+{\cdot}0_{5}12910t^2+{\cdot}0_{8}22887t^3$	196·7	35930·9	5474	4053	G
V_{133} instead of V_0 $1+{\cdot}0_{3}69205(t-133)+{\cdot}0_{5}16428(t-133)^2$	162·3	45879·6	3538	2620	W
	174·2	38593·2	4514	3343	K
$V_{48\cdot7}$ instead of V_0					
$1+{\cdot}0_{3}70048(t-48{\cdot}7)+{\cdot}0_{5}10869(t-48{\cdot}7)^2$	170·44	44262·2	3851	2852	W
$1+{\cdot}0_{3}9301t+{\cdot}0_{5}13406t^2+{\cdot}0_{8}25375t^3$	220·1	37304·1	5900	4369	G
$1+{\cdot}0_{3}9977t+{\cdot}0_{5}11430t^2+{\cdot}0_{8}31195t^3$	221·9	36839·7	6023	4460	G
$1+{\cdot}0_{3}9985t+{\cdot}0_{5}11243t^2+{\cdot}0_{8}34110t^3$	222·2	36711·6	6053	4481	G
$1+{\cdot}0_{2}10048t+{\cdot}0_{6}8342t^2+{\cdot}0_{8}48247t^3$	222·1	36735·6	6045	4476	G
$1+{\cdot}0_{2}101426t+{\cdot}0_{5}127402t^2+{\cdot}0_{8}64389t^3$	223·4	35766·4	6317	4678	E
$1+{\cdot}0_{3}9791t+{\cdot}0_{5}15880t^2+{\cdot}0_{8}16568t^3$	222·3	36655·5	6065	4490	G
$1+{\cdot}0_{2}100217t+{\cdot}0_{5}102357t^2+{\cdot}0_{8}4995t^3$	221·5	36159·1	6126	4536	E
$1+{\cdot}0_{2}10173t+{\cdot}0_{5}13201t^2+{\cdot}0_{8}63052t^3$	223·0	35374·4	6304	4668	E
$1+{\cdot}0_{3}9409t+{\cdot}0_{5}15161t^2+{\cdot}0_{8}18732t^3$	221·0	37176·0	5945	4402	G
$1+{\cdot}0_{3}9514t+{\cdot}0_{6}9663t^2+{\cdot}0_{8}2742t^3$	220·3	37720·5	5840	4324	G
V_{36} instead of V_0					
$1+{\cdot}0_{3}75009(t-36)+{\cdot}0_{5}10053(t-36)^2-{\cdot}0_{9}48165(t-36)^3$	188·17	42644·8	4412	3267	W
$1+{\cdot}0_{3}85515t-{\cdot}0_{6}31368t^2+{\cdot}0_{8}48820t^3$	195·19	40803·2	4784	3542	W
$1+{\cdot}0_{3}9037t+{\cdot}0_{5}11894t^2+{\cdot}0_{8}23030t^3$	245·7	38232·9	6426	4758	G
$1+{\cdot}0_{3}9743t+{\cdot}0_{6}8908t^2+{\cdot}0_{8}32736t^3$	245·9	38337·0	6414	4749	G
$1+{\cdot}0_{3}9558t+{\cdot}0_{5}11288t^2+{\cdot}0_{8}24548t^3$	246·5	38385·0	6422	4755	G
$1+{\cdot}0_{3}9779t+{\cdot}0_{6}8375t^2+{\cdot}0_{8}36202t^3$	246·0	38216·9	6437	4766	G
$1+{\cdot}0_{3}9626t+{\cdot}0_{5}10264t^2+{\cdot}0_{8}26427t^3$	245·8	38168·9	6440	4769	G
	244·1	36911·8	6613	4897	K
$1+{\cdot}0_{3}9481t+{\cdot}0_{5}12205t^2+{\cdot}0_{8}25055t^3$	246·4	38281·0	6437	4766	G
$1+{\cdot}0_{3}9558t+{\cdot}0_{6}8667t^2+{\cdot}0_{8}41331t^3$	247·1	38513·2	6416	4751	G
$1+{\cdot}0_{3}9323t+{\cdot}0_{5}12043t^2+{\cdot}0_{8}19892t^3$	245·8	38673·3	6356	4706	G
$1+{\cdot}0_{3}80700t+{\cdot}0_{6}80135t^2+{\cdot}0_{8}11530t^3$	213·75	43557·6	4907	3634	W

TABLE LXXF

Name.	Formula.	Boiling Point.	Density at 0°.	Density at Boiling Point.
Ethyl phenylpropionate,	$C_{11}H_{14}O_2$; $C_6H_5CH_2.CH_2COOC_2H_5$	248°·1	1·0348	0·80182
Propyl octylate, . .	$C_{11}H_{22}O_2$; $C_7H_{15}COOC_3H_7$	224 ·7	0·8805	6867
Butyl heptylate, . .	$C_{11}H_{22}O_2$: $C_6H_{13}COOC_4H_9$	225 ·1	8807	6839
Hexyl valerate, . .	$C_{11}H_{22}O_2$; $C_4H_9COOC_6H_{13}$	223 ·8	8797	6823
Heptyl butyrate, . .	$C_{11}H_{22}O_2$; $C_3H_7COOC_7H_{15}$	225 ·2	8827	6869
Octyl propionate, . .	$C_{11}H_{22}O_2$; $C_2H_5COOC_8H_{17}$	226 ·4	8833	6860
Propyl cinnamate, .	$C_{12}H_{14}O_2$; $CH(C_6H_5):CHCOOC_3H_7$	285 ·1	1·0435	7917
,, phenylpropionate,	$C_{12}H_{16}O_2$; $C_6H_5CH_2.CH_2COOC_3H_7$	262 ·1	1·0152	77886
Amyl benzoate, . .	$C_{12}H_{16}O_2$; $C_6H_5COOC_5H_{11}$	266		
Butyl acrylate, . .	$C_{12}H_{24}O_2$; $C_7H_{15}COOC_4H_9$	240 ·5	0·8797	6745
Heptyl valerate, . .	$C_{12}H_{24}O_2$; $C_4H_9COOC_7H_{15}$	243 ·6	8786	6708
Octyl butyrate, . .	$C_{12}H_{24}O_2$; $C_3H_7COOC_8H_{17}$	242 ·2	8794	6751
Heptyl caproate, . .	$C_{13}H_{24}O_2$; $C_5H_{11}COOC_7H_{15}$	259 ·4	8769	6954
Octyl valerate, . .	$C_{13}H_{26}O_2$; $C_4H_9COOC_8H_{17}$	260 ·2	8784	6618
Heptyl heptylate, . .	$C_{14}H_{28}O_2$; $C_6H_{13}COOC_7H_{15}$	274 ·6	8761	6496
Octyl caproate, . .	$C_{14}H_{28}O_2$; $C_5H_{11}COOC_8H_{17}$	275 ·2	8748	6509
Heptyl octylate, . .	$C_{15}H_{30}O_2$; $C_7H_{15}COOC_7H_{15}$	289 ·8	8754	6405
Octyl heptylate, . .	$C_{15}H_{30}O_2$: $C_6H_{13}COOC_8H_{17}$	290 ·4	8757	6419
,, octylate, . .	$C_{16}H_{32}O_2$: $C_7H_{15}COOC_8H_{17}$	305 ·9	8755	6318
Acetic anhydride, . .	$C_4H_6O_3$; $(CH_3CO)_2O$	138		
Ethyl carbonate, . .	$C_5H_{10}O_3$; $(C_2H_5)_2CO_3$	126		
Aceto-acetic ether, .	$C_6H_{10}O_3$; $CH_3.CO.CH_2COOC_2H_5$	180		
Methyl salicylate, .	$C_8H_8O_3$; $OHC_6H_4.COOCH_3$	223		
,, oxalate, . .	$C_4H_6O_4$; $CH_3OOC.COOCH_3$	162	1·1566 (54°)	
		163 ·3	1 1479 (54°)	1·0039
,, -ethyl oxalate, .	$C_5H_8O_4$; $CH_3OOC.COOC_2H_5$	173 ·7	1·15565	0·94693
,, malonate, . .	$C_5H_8O_4$; $CH_2(COOCH_3)_2$	180 ·7	1·1753	9569
Ethyl oxalate, . .	$C_6H_{10}O_4$; $C_2H_5OOC.COOC_2H_5$	186	1·1025	
		186	1·1030	87652
Methyl succinate, . .	$C_6H_{10}O_4$; $COOCH_3CH_2.CH_2COOCH_3$	195 ·2	1·1162	91200
Ethyl malonate, . .	$C_7H_{12}O_4$; $CH_2(COOC_2H_5)_2$	198 ·4	1·07607	8623
Methyl-ethyl succinate,	$C_7H_{12}O_4$; $COOCH_3CH_2.CH_2.COOC_2H_5$	208 ·2	1·0925	86482
Propyl oxalate, . .	$C_8H_{14}O_4$; $C_3H_7OOC.COOC_3H_7$	213 ·5	1·0384	80601
Ethyl propyl malonate,	$C_8H_{14}O_4$; $CH_2\left\langle\begin{matrix}COOC_2H_5\\COOC_3H_7\end{matrix}\right.$	211	1·04977	8354
,, succinate, . .	$C_8H_{14}O_4$; $COOC_2H_5.CH_2.CH_2.COOC_2H_5$	217	1·0718	
		215 ·4	1·0596	82726
Propyl malonate, . .	$C_9H_{16}O_4$; $CH_2(COOC_3H_7)_2$	228 ·3	1·02705	7997
Ethyl-propyl succinate, .	$C_9H_{16}O_4$; $COOC_2H_5CH_2CH_2COOC_3H_7$	231 ·1	1·03866	8148
Butyl oxalate, . .	$C_{10}H_{18}O_4$; $C_4H_9OOC.COOC_4H_9$	243 ·4	1·0099	780
Ethyl-butyl succinate, .	$C_{10}H_{18}O_4$; $COOC_2H_5.CH_2.CH_2COOC_4H_9$	247	1·02178	7875
Propyl succinate, . .	$C_{10}H_{18}O_4$; $COOC_3H_7.CH_2CH_2COOC_3H_7$	247 ·1	1·0189	7818
Ethyl-heptyl oxalate, .	$C_{11}H_{20}O_4$; $COOC_2H_5.COOC_7H_{15}$	263 ·7	0·9954	7549
Butyl malonate, . .	$C_{11}H_{20}O_4$; $CH_2(COOC_4H_9)_2$	251 ·5	1·0049	80007
Propyl-butyl succinate, .	$C_{12}H_{20}O_4$; $COOC_3H_7CH_2CH_2COOC_4H_9$	258 ·7	1·0106	7759
,, -heptyl oxalate, .	$C_{12}H_{22}O_4$; $COOC_3H_7.COOC_7H_{15}$	284 ·4	0·9814	7267
,, -octyl oxalate, .	$C_{13}H_{24}O_4$; $COOC_3H_7COOC_8H_{17}$	291 ·1	97245	7151
Ethyl-heptyl succinate .	$C_{13}H_{24}O_4$; $COOC_2H_5CH_2CH_2COOC_7H_{15}$	291 ·4	9850	7313
Heptyl succinate, . .	$C_{18}H_{34}O_4$; $(COOC_7H_5CH_2)_2$	350 ·1	95185	6817
Ethyl monochloracetate,	$C_4H_7ClO_2$; $CH_2ClCOOC_2H_5$	145		
,, dichloracetate, .	$C_4H_6Cl_2O_2$; $CHCl_2COOC_2H_5$	157 ·7		
,, trichloracetate, .	$C_4H_5Cl_3O_2$; $CCl_3COOC_2H_5$	167		
α-β-Dibrompropyl alcohol,	$C_3H_6Br_2O$; $CH_2Br.CHBr.CH_2.OH$	219	2·1682	1·7535

—continued.

$V^t = V_0$ multiplied by	Molecular Volume at Boiling Point. Liquid.	Gaseous.	$\mathfrak{b}$ at Boiling-Point.	$\mathfrak{v}$ at Boiling-Point.	
$1+{\cdot}0_{3}92504t+{\cdot}0_{7}99212t^2+{\cdot}0_{8}35974t^3$	221·48	41724·0	$0{\cdot}0_{2}5308$	$0{\cdot}0_{2}3930$	W
$1+{\cdot}0_{3}9106t+{\cdot}0_{6}9541t^2+{\cdot}0_{8}25974t^3$	270·3	39850·3	6783	5023	G
$1+{\cdot}0_{3}9111t+{\cdot}0_{5}12843t^2+{\cdot}0_{8}15475t^3$	271·3	39882·3	6802	5037	G
$1+{\cdot}0_{3}9547t+{\cdot}0_{6}6232t^2+{\cdot}0_{8}3963t^3$	272·0	39778·3	6838	5063	G
$1+{\cdot}0_{3}9119t+{\cdot}0_{5}13663t^2+{\cdot}0_{9}9092t^3$	270·2	39890·4	6773	5015	G
$1+{\cdot}0_{3}9214t+{\cdot}0_{5}10430t^2+{\cdot}0_{8}24376t^3$	270·5	39986·4	6765	5009	G
$1+{\cdot}0_{3}84152t+{\cdot}0_{6}58474t^2+{\cdot}0_{8}13206t^3$	239·43	44686·5	5358	3967	W
$1+{\cdot}0_{3}93098t+{\cdot}0_{7}50360t^2+{\cdot}0_{8}31061t^3$	245·96	42844·9	5741	4251	W
	247·7	43157·2	5739	4250	K
$1+{\cdot}0_{3}9323t+{\cdot}0_{6}7770t^2+{\cdot}0_{8}25184t^3$	295·9	41115·4	7197	5329	G
$1+{\cdot}0_{3}8886t+{\cdot}0_{6}9440t^2+{\cdot}0_{8}26166t^3$	297·4	41363·7	7190	5324	G
$1+{\cdot}0_{3}9004t+{\cdot}0_{5}10729t^2+{\cdot}0_{8}15116t^3$	295·6	41251·6	7166	5306	G
$1+{\cdot}0_{3}8755t+{\cdot}0_{6}8849t^2+{\cdot}0_{8}24752t^3$	323·9	42628·8	7557	5591	G
$1+{\cdot}0_{3}8692t+{\cdot}0_{6}8694t^2+{\cdot}0_{8}23965t^3$	322·6	42692·8	7556	5595	G
$1+{\cdot}0_{3}8548t+{\cdot}0_{6}8843t^2+{\cdot}0_{8}22900t^3$	350·2	43845·8	7987	5914	G
$1+{\cdot}0_{3}8710t+{\cdot}0_{6}7217t^2+{\cdot}0_{8}23836t^3$	349·6	43893·9	7965	5898	G
$1+{\cdot}0_{3}8570t+{\cdot}0_{6}5453t^2+{\cdot}0_{8}29835t^3$	377·0	45062·9	8366	6195	G
$1+{\cdot}0_{3}8517t+{\cdot}0_{6}7153t^2+{\cdot}0_{8}23464t^3$	376·2	45110·9	8339	6175	G
$1+{\cdot}0_{3}8362t+{\cdot}0_{6}6458t^2+{\cdot}0_{8}24248t^3$	404·3	46352·0	8722	6458	G
	109·9	32908·3	3340	2473	Z
$1+{\cdot}0_{2}11711t+{\cdot}0_{6}52596t^2+{\cdot}0_{8}98521t^3$	138·8	31947·4	4345	3217	K
	153·3	36271·2	4226	3129	S
	157·0	39714·2	3953	2927	K
	116·3	34829·9	3339	2472	K
V_{54} instead of V_0 $1+{\cdot}0_{2}11991(t-54)-{\cdot}0_{6}56231(t-54)^2+{\cdot}0_{7}22178(t-54)^3$	117·3	34934·0	3358	2487	W
$1+{\cdot}0_{3}95597t+{\cdot}0_{5}27055t^2-{\cdot}0_{8}52021t^3$	139·1	35766·8	3889	2880	Wn
$1+{\cdot}0_{3}99871t+{\cdot}0_{6}28145t^2+{\cdot}0_{8}65465t^3$	137·6	36327·2	3788	2805	Wn
	166·18	36751·6	4539	3361	K
	166·2	36751·6	4522	3348	W
$1+{\cdot}0_{2}10030t+{\cdot}0_{6}27596t^2+{\cdot}0_{8}53698t^3$	159·72	37488·3	4260	3154	W
$1+{\cdot}0_{3}91846t+{\cdot}0_{5}18585t^2+{\cdot}0_{8}11017t^3$	185·1	37744·5	4904	3631	Wn
$1+{\cdot}0_{3}91446t+{\cdot}0_{5}16461t^2+{\cdot}0_{9}15924t^3$	184·58	38529·2	4791	3548	W
$1+{\cdot}0_{2}10036t+{\cdot}0_{6}74085t^2+{\cdot}0_{8}41394t^3$	215·4	38953·5	5530	4095	W
$1+{\cdot}0_{3}90044t+{\cdot}0_{5}15097t^2-{\cdot}0_{10}690t^3$	207·8	38753·4	5362	3970	Wn
	209·0	39233·8	5327	3945	K
$1+{\cdot}0_{2}10354t+{\cdot}0_{6}40999t^2+{\cdot}0_{8}38411t^3$	209·85	39105·7	5344	3957	W
$1+{\cdot}0_{3}89102t+{\cdot}0_{5}14002t^2+{\cdot}0_{9}9669t^3$	234·6	40138·6	5845	4328	Wn
$1+{\cdot}0_{3}84245t+{\cdot}0_{5}23954t^2-{\cdot}0_{8}41652t^3$	230·2	40290·7	5713	4230	Wn
$1+{\cdot}0_{3}80644t+{\cdot}0_{5}2640t^2-{\cdot}0_{8}40184t^3$	258·4	41347·6	6249	4627	Wn
$1+{\cdot}0_{3}87211t+{\cdot}0_{5}13242t^2-{\cdot}0_{9}1931t^3$	255·9	41635·9	6146	4551	Wn
$1+{\cdot}0_{3}86975t+{\cdot}0_{5}15872t^2-{\cdot}0_{9}8482t^3$	257·8	41643·9	6191	4584	Wn
$1+{\cdot}0_{3}79762t+{\cdot}0_{5}21837t^2-{\cdot}0_{8}2595t^3$	284·9	42973·1	6630	4909	Wn
$1+{\cdot}0_{3}73533t+{\cdot}0_{5}36048t^2-{\cdot}0_{8}9922t^3$	269·1	41996·2	6408	4745	Wn
$1+{\cdot}0_{3}84567t+{\cdot}0_{5}16659t^2-{\cdot}0_{8}182t^3$	277·8	42572·7	6525	4832	Wn
$1+{\cdot}0_{3}85140t+{\cdot}0_{5}13816t^2-{\cdot}0_{9}1657t^3$	315·7	44630·5	7074	5238	Wn
$1+{\cdot}0_{3}8310t+{\cdot}0_{5}13017t^2-{\cdot}0_{9}1248t^3$	340·4	45167·0	7534	5579	Wn
$1+{\cdot}0_{3}843t+{\cdot}0_{5}1098t^2+{\cdot}0_{9}1509t^3$	332·9	45191·0	7367	5455	Wn
$1+{\cdot}0_{3}77442t+{\cdot}0_{5}11439t^2-{\cdot}0_{9}4428t^3$	459·6	49891·1	9212	6821	Wn
	123·09	33468·7	3678	2723	S
	143·44	34485·6	4159	3080	S
	163·85	35230·3	4651	3444	S
$1+{\cdot}0_{3}74036t-{\cdot}0_{6}17744t^2+{\cdot}0_{8}78943t^3$	123·96	39393·9	3147	2330	W

TABLE LXXI

Name.	Formula.	Boiling Point.	Density at 0°.	Density at Boiling Point.
Methyl-α-β-dibrompropionate,	$C_4H_6Br_2O_2$; $CH_2Br.CHBrCOOCH_3$	205 ·8	1·9777	1·6140
Ethyl ,, ,,	$C_5H_8Br_2O_2$; $CH_2Br.CHBr.COOC_2H_5$	214 ·6	1·8279	1·4554
n-Propyl ,, ,,	$C_6H_{10}Br_2O_2$; $CH_2Br.CHBrCOOC_3H_7$	233	1·7014	1·3391
Methyl cyanide,	C_2H_3N ; CH_3CN	74		
		81 ·3		
Ethyl ,,	C_3H_5N ; C_2H_5CN	97 ·1	0·80101	0·70098
		97		
Allyl amine,	C_3H_7N ; $NH_2C_3H_5$	56		
Propyl ,,	C_3H_9N ; $NH_2C_3H_7$	49 ·6		
Pyroline,	C_4H_7N	133		7276
Diethyl amine,	$C_4H_{11}N$; $NH(C_2H_5)_2$	56		
Isobutyl ,,	$C_4H_{11}N$; $NH_2C_4H_9$	67 ·7		
Pyridine,	C_5H_5N	116		
Valeronitril,	C_5H_9N ; $C_4H_9.CN$	129		
Piperidine,	$C_5H_{11}N$	105		
Aniline,	C_6H_7N	184		
		183 ·7	1·03790	87274
		183 ·1		
Picoline,	C_6H_7N	133 ·5	0·96161	83258
Capronitril,	$C_6H_{11}N$; $C_5H_{11}CN$	154		
Triethyl amine,	$C_6H_{15}N$; $N(C_2H_5)_3$	89		
Benzonitril,	C_7H_5N ; C_6H_5CN	191		
Lutidine,	C_7H_9N	154		7916
Collidine,	$C_8H_{11}N$	173		7839
Dimethyl aniline,	$C_8H_{11}N$	190		7941
Chinoline,	C_9H_7N	234		
Triallyl amine,	$C_9H_{15}N$; $N(C_3H_5)_3$	155 ·5	8206	6826
Tripropyl ,,	$C_9H_{21}N$; $N(C_3H_7)_3$	156 ·5	7699	6426
Diphenyl ,,	$C_{12}H_{11}N$; $NH(C_6H_5)_2$	310		8293
Diallyl aniline,	$C_{12}H_{15}N$	244	9680	7667
Dipropyl ,,	$C_{12}H_{19}N$	245 ·4	9240	7267
Di-isopropyl aniline,	$C_{12}H_{19}N$	221	9338	7504
Azobenzol,	$C_{12}H_{10}N_2$; $C_6H_5N:NC_6H_5$	293		8256
Nitromethane,	CH_3NO_2	101		
Nitroethane,	$C_2H_5NO_2$	114		
Nitrobenzol,	$C_6H_5NO_2$	218		
Ethyl nitrate,	$C_2H_5NO_3$	86		
Isoamyl ,,	$C_5H_{11}NO_3$	147		
Ethyl sulphide,	$C_4H_{10}S$	91		
		46 ·5		
Amyl mercaptan,	$C_5H_{12}S$	120		
Methyl disulphide,	$C_2H_6S_2$	114		
Ethyl sulphite,	$C_4H_{10}SO_3$	160		
Methyl thiocyanate,	C_2H_3NS	133		
Mustard oil,	C_4H_5NS	148		
		151 ·3		
Phenyl mustard oil,	C_7H_5NS	219 ·8		
Ethoxy-phosphorchloride,	$PCl_2C_2H_5O$	117 ·5	1·30527	1·13989
Phosphenyl chloride,	$PCl_2C_6H_5$	224 ·6	1·3428	1·10415
Trimethyl phosphate,	$C_3H_9PO_4$; $(CH_3)_3PO_4$	197 ·2		
Dimethyl-ethyl phosphate,	$C_4H_{11}PO_4$; $(CH_3)_2C_2H_5PO_4$	203 ·3		

B = Buff. D = Dobriner. E = Elsasser. G = Gartenmeister. K = Kopp. P = Pierre. Pt = Pinette. S = Schiff.

—continued.

$Vt = V_0$ multiplied by	Molecular Volume at Boiling Point.		$\mathfrak{b}$ at Boiling Point.	$\mathbf{v}$ at Boiling Point.	
	Liquid.	Gaseous.			
$1 + \cdot 0_3 88998t + \cdot 0_6 15041t^2 + \cdot 0_8 41201t^3$	151·99	38337·0	$0 \cdot 0_2 3965$	$0 \cdot 0_2 2936$	W
$1 + \cdot 0_3 99128t - \cdot 0_5 10801t^2 + \cdot 0_8 94009t^3$	178·14	39041·6	4563	3379	W
$1 + \cdot 0_3 93976t - \cdot 0_6 28435t^2 + \cdot 0_8 52020t^3$	204·09	40514·9	5037	3730	W
$1 + \cdot 0_2 12118t + \cdot 0_5 17780t^2 + \cdot 0_7 15322t^3$	54·3	27783·8	1954	1447	R
	57·2	28368·3	2016	1493	S
$1 + \cdot 0_2 122775t + \cdot 0_5 204064t^2 + \cdot 0_8 4675t^3$	78·35	28633·4	2736	2026	Th
	78·3	29625·4	2643	1957	S
	78·4	26342·5	2976	2204	S
	85·6	24830·1	3447	2552	S
	92·1				St
	109·1	26342·5	4142	3067	S
	106·2	27279·3	3893	2883	S
	89·4	31146·7	2870	2125	S
	119·7	32187·6	3779	2798	S
	108·6	30265·9	3588	2657	S
	106·4	36591·5	2908	2153	K
$1 + \cdot 0_3 86295t + \cdot 0_6 27351t^2 + \cdot 0_8 3466t^3$	106·37	36567·5	2909	2154	Th
	106·1	36512·6	2906	2152	S
$1 + \cdot 0_3 966534t + \cdot 0_6 845901t^2 + \cdot 0_8 45669t^3$	111·50	32547·9	3426	2537	Th
	141·1	34189·4	4127	3056	S
	153·8	28984·8	5306	3929	S
	121·6	37152·0	3273	2424	K
	135·1	34189·4	3952	2926	St
	157·9	35710·7	4422	3274	St
	152·4	37071·9	4111	3044	St
	139·8	40595·0	3444	2550	S
$1 + \cdot 0_2 10119t + \cdot 0_5 15077t^2 + \cdot 0_8 24849t^3$	200·3	34349·5	5831	4318	Z
$1 + \cdot 0_2 10424t + \cdot 0_5 11031t^2 + \cdot 0_8 21272t^3$	222·1	34389·6	6458	4782	Z
	203·8	46680·3	4366	3233	St
$1 + \cdot 0_3 82066t + \cdot 0_6 96308t^2 + \cdot 0_9 3372t^3$	225·2	41395·7	5440	4028	Z
$1 + \cdot 0_3 79881t + \cdot 0_5 12057t^2 + \cdot 0_9 1936t^3$	243·1	42507·8	5484	4061	Z
$1 + \cdot 0_3 85248t + \cdot 0_5 12529t^2 - \cdot 0_9 45689t^3$	235·4	39554·1	5951	4407	Z
	220·4	45319·1	4863	3601	St
	59·5	29945·7	1987	1471	S
	80·2	30986·6	2588	1909	S
	124·9	39313·9	3177	2353	K
$1 + \cdot 0_2 11290t + \cdot 0_5 47915t^2 - \cdot 0_7 18413t^3$	90·1	28744·6	3135	2321	K
	153·6	33628·9	4567	3382	S
$1 + \cdot 0_2 119643t + \cdot 0_5 180653t^2 + \cdot 0_8 78821t^3$	121·5	29145·0	4169	3087	P
	62·1	24581·8	2526	1870	S
	140·1	31467·0	4452	3297	K
	100·7	30986·6	3250	2407	P
	148·8	34669·8	4292	3178	K
	78·2	32507·9	2406	1782	P
$1 + \cdot 0_2 10713t + \cdot 0_7 3270t^2 + \cdot 0_8 73569t^3$	113·9	33709·0	3379	2502	K
	113·1	33973·2	3329	2465	S
	143·4	39458·0	3634	2691	S
$1 + \cdot 0_2 102304t + \cdot 0_5 187367t^2 - \cdot 0_9 61t^3$	128·61	31266·8	4114	3046	Th
$1 + \cdot 0_3 8258t + \cdot 0_6 14461t^2 + \cdot 0_6 2863t^3$	161·68	39842·3	4058	3005	Th
$1 + \cdot 0_2 10516t - \cdot 0_5 19105t^2 + \cdot 0_7 13351t^3$	139·45	37648·4	3438	2546	W
$1 + \cdot 0_3 95262t - \cdot 0_6 57662t^2 + \cdot 0_8 77127t^3$	161·45	33136·8	4872	3608	W

St = Stadel. W = Weger. Wn = Winkelmann.
Th = Thorpe. Wns = Wiens. Z = Zander.

LXXI.—Capillarity and Surface Tension.

Poisson found that, when a disc of radius R is pulled vertically upwards from the surface of a liquid,—

$$p = \pi R^2 hs,$$

where p = force exerted at the moment of separation,
h = length of the raised column of liquid,
s = density of liquid,

and

$$h = a\sqrt{2} - a^2/3R,$$

where a is a constant depending on the nature of the liquid. If R is very large then, practically,—

$$h = a\sqrt{2},$$

where a^2 = specific cohesion of the liquid.

For any given liquid in contact with a given solid with a definite intimateness of contact—this intimateness to some extent depending upon the condition as well as upon the nature of the solid—there is for every specified temperature a definite angle of contact between the liquid and solid surfaces, which is practically independent of the direction of these surfaces as regards the vertical. This angle we denote by ϑ and sometimes by θ.

Every liquid behaves as if the thin film forming its exterior surface was in a state of tension, because the molecules which form the surface of the liquid are subject to attraction (or repulsion) by other liquid molecules only on one side. This tension must be expressed in units of force per linear unit, and is usually denoted by α; it is identical with Laplace's H/2.

If a solid wall or plate be dipped perpendicularly into a liquid the surface of the liquid in the immediate vicinity of the wall will be distorted by the elevation or depression of a certain mass of the liquid. This distortion will result from the force α acting throughout l, the length of the wall, at an angle ϑ with the vertical, so that the mass of liquid displaced will be,—

$$l\alpha \cos \vartheta.$$

If ϑ be less than 90° the cosine will be positive and the liquid will be raised, while if $\vartheta > 90°$ the cosine will be negative and the effect will be a depression. If the wall be circular with radius r we get,—

$$l = 2\pi r,$$

and the weight of liquid displaced becomes,—

$$2\pi r\alpha \cos \vartheta.$$

Putting h for the length of the displaced column of liquid, and supposing the meniscus to be hemispherical, we get for its volume,—

$$\pi r^2(h \pm r/3),$$

and if σ represents the density of the liquid, its mass will be,—

$$\pi r^2\sigma(h \pm r/3),$$

and therefore,—

$$2\pi r\alpha \cos \vartheta = \pi r^2\sigma(h \pm r/3) = \pi r^2 h\sigma(1 \pm r/3h).$$

If the meniscus be a semi-ellipsoid of revolution:—

$$2\pi r\alpha \cos \vartheta = \pi r^2 h\sigma(1 \pm r/3h - r^2/9h^2 \pm 2r^3/27h^3 U).$$

As r is generally very small as compared with $3h$ we may, in most cases, take—

$$2\pi r a \cos \vartheta = \pi r^2 h\sigma,$$

and,
$$h = 2a \cos \vartheta / r\sigma \; ; \; \cos \vartheta = hr\sigma/2a.$$

Now for the same liquid at a constant temperature a, σ, and ϑ remain constant, so—

$$h \propto 1/r,$$

which expresses Jurin's law.

When $r = 1$ we get
$$h = 2a \cos \vartheta/\sigma,$$

and if the liquid wets the tube $\vartheta = 0$ and $\cos \vartheta = 1$, so—

$$h = 2a/\sigma = a^2 = \text{specific cohesion.}$$

Between two parallel plates separated by a distance d,—

$$h = 2a \cos \vartheta / d\sigma.$$

Putting $\beta \equiv$ adhesion constant of the liquid and solid, we get

$$\cos \vartheta = \beta/a,$$

and the expression for the height to which a liquid will be displaced in a tube of radius r becomes

$$h = 2\beta/r\sigma.$$

When the liquid thoroughly wets the solid we have, as seen above,

$$\cos \vartheta = 1,$$

and therefore,

$$a = \beta.$$

As $\beta = a \cos \vartheta$, it is evident that β can never exceed a, but in every case, except where $\vartheta = 0$, the numerical value of β will be smaller than that of a.

The following are the symbols generally employed and their significations :—

Surface tension, or capillarity constant, H/2 (Laplace) $= a = a^2\sigma$ (Gauss) : in the tables generally given in mgms. per mm. length ; ag gives surface energy per cm.^{2} in ergs ; or surface tension per cm. in dynes.

Specific cohesion, $a^2 = \mathrm{H}/\sigma$ (Laplace) $= 2a^2$ (Gauss) $= 2a/\sigma$: denotes in mms. the extent to which a liquid is raised or depressed in a tube whose radius is 1 mm.

Adhesion constant, $\beta = a \cos \vartheta$: expressed in terms of same units as a.

Contact angle, $\vartheta = \cos^{-1} (\beta/a)$.

When a large drop of liquid rests on a horizontal smooth surface, or a bubble of air (or other gas) is formed against such a surface, the drop or bubble will assume, on the side furthest from the plane, the figure of a solid of revolution : and if

H = distance between plane and the point in the surface of the drop or bubble furthest from it = maximum thickness of drop or bubble ;

h = distance between the point referred to above and the maximum horizontal section of drop or bubble = distance between highest or lowest point and the plane meeting the surface of the drop or bubble at every point where the tangent to such surface is vertical ;

then, taking a, a^2, ϑ, and σ with the same significations as before, we get—

$$a = \sigma h^2/2 \text{ in gravitation units} = g\sigma h^2/2 \text{ in absolute units;}$$

also
$$a = \sigma \mathrm{H}^2 \, (2 + 2 \cos \vartheta) \quad ,, \quad = g\sigma \mathrm{H}^2/(2 + 2 \cos \vartheta) \quad ,,$$

whence,—

$$h^2 = \mathrm{H}^2/(1+\cos\vartheta),$$

$$\therefore \cos\vartheta = (\mathrm{H}^2 - h^2)/h^2.$$

Since

$$a = g\sigma\mathrm{H}^2/(2+2\cos\vartheta) = g\sigma\mathrm{H}^2/4\cos^2\frac{\vartheta}{2}$$

$$\mathrm{H}^2 = 4a\cos^2\frac{\vartheta}{2}/g\sigma;$$

that is, when the surface of a drop or bubble ceases to be a portion of an exact spherical surface, the maximum thickness of the drop or bubble is quite independent of its magnitude.

$$\cos\frac{\vartheta}{2} = \mathrm{H}/h\sqrt{2}.$$

Eötvös finds the value of a (square root of the "specific cohesion") by measuring the angle between the surface-normal and the vertical at two points of different elevation on the curved surface of a liquid. If ϕ denote this angle and Z the height of the point above the plane of no curvature, we get for any point

$$\mathrm{Z} = a\sqrt{2}\sin\frac{\phi}{2}.$$

Denoting by Z_1, ϕ_1; Z_2, ϕ_2, the values as determined for two points such as referred to above, we have

$$a = \frac{\mathrm{Z}_2 - \mathrm{Z}_1}{\sqrt{2}\left(\sin\frac{\phi_2}{2} - \sin\frac{\phi_1}{2}\right)}.$$

In the case of a drop falling from the horizontal end of a cylindrical tube of radius r, supposing that at the instant of separation the section of the drop at the end of the tube is circular with radius r, we have the surface tension $2\pi ra$ round the circumference just in equilibrium with the total downward force, *i.e.* the weight of the drop + excess of pressure of liquid inside over the atmospheric pressure. Put w = weight of drop

$$2\pi ra = w + \pi ra \text{ or } \pi ra = w.$$

But this formula is not quite accurate, as the form of the drop at the instant of separation is never exactly that assumed. Lord Rayleigh finds that practically

$$w = 3{\cdot}8ra$$

is much nearer the truth than

$$w = 3{\cdot}14159ra.$$

The equation generally used,

$$w = 2\pi ra,$$

is entirely wrong, as it ignores the change of pressure inside the drop caused by the curvature of its surface.

For the same tube the number of drops is supposed to be proportional to $2a/\sigma$, but Duclaux found that with a pipette which at 20° C. gave 100 drops for 5 c. cms. of water the following corrections had to be made:—

Number of drops up to	140	150	160	170	180	190	200	210	220	230	240	250	260
Deduct . . .	0	1	2	2·5	3	4	5	6	7	8·5	10	11	12

and one more for every 20 drops above 260.

Réveil reports the following results as having been obtained at 15° C. :—

Liquid.	Number of Drops to a Gramme.	Weight of Drop.	Surface Tension. α
Distilled water,	20	0·0500	7·50
Alcohol (86°),	62	0160	2·40
Sulphuric ether,	90	0111	1·66
Acetic ether,	39	0256	5·85
Glycerine,	24	0416	3·60
Chloroform,	60	0166	2·49
Sulphuric acid,	28	0350	5·25
Nitric ,,	27	0370	5·55
Hydrochloric ,,	20	0500	7·50
Hydrocyanic ,, ($\frac{1}{8}$)	25	0402	6·03
,, ,, ($\frac{1}{4}$)	24	0420	6·30
Ammonia (23°),	22	0454	6·81
Caustic soda (36°),	16	0636	2·40
Silver nitrate solution (equal parts),	20	0500	7·50
,, ,, ($\frac{1}{4}$)	20	0500	7·50
,, ,, ($\frac{1}{8}$)	20	0500	7·50
Turpentine,	54	0185	3·45
Olive oil,	47	0212	2·18
Almond oil,	47	0212	2·18
Sugar solution (10%),	20	0500	7·50

Poisson's method of detaching a plate or disc of radius r will also serve for the calculation of α, etc., according to the following formulæ.

p = force exerted at moment of separation, as before;
h = height of lower surface of the horizontal disc above the undisturbed level of the liquid;
P = atmospheric pressure per unit area.

$$2\alpha + \mathrm{P}h - \tfrac{1}{2}g\sigma h^2 = \mathrm{P}h,$$

$$\therefore h^2 = 4\alpha/g\sigma.$$

And $$p = \pi r^2 hg\sigma = \pi r^2 g\sigma\sqrt{4\alpha/g\sigma} = 2\pi r^2\sqrt{\alpha g\sigma} = 6{\cdot}2832r^2\sqrt{\alpha g\sigma},$$

so when p, r and σ are accurately known, α can be easily calculated—

$$\alpha = 0{\cdot}025333p^2/r^4g\sigma.$$

The "Method of Ripples" has been of late years used for the determination of surface tension with very satisfactory results. Putting

V = velocity of wave propagation,
λ = wave length,
n = wave frequency,
h = depth of liquid,

Lord Kelvin finds that with a force f

$$\mathrm{V}^2 = \frac{f\lambda}{2\pi}\tanh\frac{2\pi h}{\lambda} = n^2\lambda^2 \qquad (a)$$

When a series of waves are propagated on the surface of a liquid the surface tension has the effect of increasing the pressure at the crests of the waves and diminishing it in the troughs, so—

$$f = g + 4\pi^2 a/\lambda^2\sigma \quad . \quad . \quad . \quad . \quad (b)$$

and therefore

$$V^2 = n^2\lambda^2 = (g + 4\pi^2 a/\lambda^2\sigma)(\lambda/2\pi)\tanh\frac{2\pi h}{\lambda}$$

$$= (g\lambda/2\pi + 2\pi a/\lambda\sigma)\tanh\frac{2\pi h}{\lambda} \quad . \quad . \quad . \quad (c)$$

$$\therefore\ a = \sigma\left(\coth\frac{2\pi h}{\lambda}\cdot n^2\lambda^3/2\pi - g\lambda^2/4\pi^2\right) \quad . \quad . \quad . \quad (d)$$

Now $\coth\chi = \cosh\chi/\sinh\chi = 1/\tanh\chi = \dfrac{\frac{1}{2}(e^{\chi}+e^{-\chi}}{\frac{1}{2}(e^{\chi}-e^{-\chi}} = \dfrac{1+e^{-2\chi}}{1-e^{-2\chi}}$;

so—

$$a = \sigma\left(\frac{1+e^{-\frac{4\pi h}{\lambda}}}{1-e^{-\frac{4\pi h}{\lambda}}}\cdot\frac{n^2\lambda^3}{2\pi} - \frac{g\lambda^2}{4\pi^2}\right) = \sigma\left\{\left(1+2e^{-\frac{4\ h}{\lambda}}\right)\cdot n^2\lambda^3/2\pi - g\chi^2 4/\pi^2\right\} \quad . \quad (d_1)$$

unless h be quite insignificant as compared with λ. When $\lambda = 0{\cdot}5$ cm. and $h = 1{\cdot}1$ cm. (the limiting values used by Dorsey in his investigations), we get $4\pi h/\lambda = 27{\cdot}6+$; so $e^{-\frac{4\pi h}{\lambda}}$ is less than $1/(9{\cdot}69\times 10'')$, and consequently $\coth\frac{2\pi h}{\lambda}$ differs from unity by less than $1/(4{\cdot}8\times 10'')$; when $\lambda = 0{\cdot}5$ and $h = 0{\cdot}4$ the difference from unity is only about 1/2300, and when h is as small as 0·3 the deviation is only 1/1900; so we may, in all cases likely to occur in using the method of ripples, take $\coth\frac{2\pi h}{\lambda} = 1 = \tanh\frac{2\pi h}{\lambda}$, and equation ($c$) becomes

$$V^2 = n^2\lambda^2 = g\lambda/2\pi + 2\pi a/\lambda\sigma \quad . \quad . \quad . \quad . \quad (e)$$

$$\therefore\ V = \sqrt{(\lambda/2\pi)(g + 4\pi^2 a/\lambda^2\sigma}) \quad . \quad . \quad . \quad . \quad (e_1)$$

This will be a minimum when $g = 4\pi^2 a/\lambda^2\sigma$, which gives for λ_m (wave-length corresponding to minimum velocity)

$$\lambda_m = 2\pi\sqrt{a/g\sigma} \quad . \quad . \quad . \quad . \quad . \quad . \quad (f)$$

and the minimum velocity will be

$$\sqrt{2}\ (ag/\sigma)^{\frac{1}{4}} \quad . \quad . \quad . \quad . \quad . \quad . \quad (g)$$

Thus for water at 0° C. we have given $a = 77{\cdot}74$, and by equations (f) and (g) we find that

$$\lambda_m = 1{\cdot}78 \text{ cm.}$$

and the minimum velocity = 23·5 cm./sec.

In other words, no wave can travel on the surface of ice-cold water with a smaller velocity than 23·5 centimetres per second. Acting on Lord Kelvin's suggestion, the term "waves" is now confined to such as have wave-lengths not less than λ_m, and the term "ripples" (Germ. *Kräuselungen*) to those with wave-lengths less than λ_m.

When the effect of surface tension is negligible we have what may be termed pure "gravitation waves," and for these the term involving a vanishes and equation (e) becomes

$$V^2 = (g\lambda/2\pi)\tanh\frac{2\pi h}{\lambda} \quad . \quad . \quad . \quad . \quad (h)$$

and when λ is large compared with h

$$V = \sqrt{gh} \quad . \quad . \quad . \quad . \quad (i)$$

when λ is small in comparison with h

$$V=\sqrt{g\lambda/2\pi} \qquad (j)$$

For waves, whose lengths from crest to crest exceeds λ_m, the principal force concerned in their motion is gravitation; for ripples the principal force concerned is surface tension. For ripples, as we have already seen, equation (d_1) may be written

$$a=\sigma(n^2\lambda^3/2\pi - g\lambda^2/4\pi^2) \qquad (k)$$

For the production of ripples a tuning fork is generally employed, and if t = time of vibration of fork, then $t=n^{-1}$ and

$$a=\sigma(\lambda^3/2\pi t^2 - g\lambda^2/4\pi^2)=(\sigma/2\pi)(\lambda^3/t^2 - g\lambda^2/2\pi) \qquad (l)$$

For convenience in calculation we may write equation (k) as follows :—

$$a=(\sigma n^2\lambda^3/2\pi)(1-g/2\pi n^2\lambda) \qquad (m)$$

or near enough for all practical purposes.

$$a=0{\cdot}15915\ \sigma n^2\lambda^3(1-156/n^2\lambda) \qquad (m_1)$$

In actual working the second term within the bracket will be generally small, but not always negligible; three figures of the initial coefficient will be sufficient, except in calculating the results of very careful experiments with very accurate apparatus.

For a liquid of infinite depth in contact with air (or other gas) Lamb gives—

$$V^2=\frac{\sigma-\rho}{\sigma+\rho}\cdot\frac{g\lambda}{2\pi}+\frac{2\pi a}{(\sigma+\rho)\lambda}$$

$$a=(\sigma+\rho)\left\{\frac{n^2\lambda^3}{2\pi}-\frac{\sigma-\rho}{\sigma+\rho}\cdot\frac{g\lambda^2}{4\pi^2}\right\}$$

where ρ = density of air (or other gas).

Lenard determined the values of a by observing the oscillations of large spherical drops, relieved from the effects of gravitation by being suspended in a non-mixing liquid of practically identical density. Putting t for time of gravest vibration about the spherical form after distortion, r for radius of drop, he found

$$t=(\pi/\sqrt{2})\sqrt{\sigma r^3/a}=2{\cdot}22144\sqrt{\sigma r^3/a} \qquad (n)$$

so

$$a=\frac{\pi^2\sigma r^3}{2t^2}=4{\cdot}9348\ \sigma r^3/t^2 \qquad (n_1)$$

At 4° C. the period of a spherical drop of water with radius of 2·5 cms., when oscillating about the spherical form under the action of surface tension alone, is almost exactly 1 second.

For a spherical cavity of radius r with one free surface, such as an air bubble in a liquid, the excess of pressure inside the cavity over that outside is—

$$2a/r,$$

and for a bubble with two free surfaces and very thin envelope, such as a soap bubble floating in air, the difference is—

$$4a/r.$$

Jäger based his experimental method on this difference of pressure—he estimated the least pressure that would force bubbles of air from the narrow orifice of a capillary tube dipping beneath the surface of a liquid; the method is better adapted for comparative than for absolute measurements.

TABLE LXXIA.—**Capillarity Constants of Water, Alcohol, Benzol, Acetone, Carbon Disulphide, and Ether.** (J. C.-E.)

t° C.	Water.		Alcohol.		Benzol.		Acetone.		Carbon Disulphide.		Ether.	
	Ascent in mms. in tube 1 mm. radius.	Ascent in ·01's in. in tube ·01 in. radius.	Ascent in mms. in tube 1 mm. radius.	Ascent in ·01's in. in tube ·01 in. radius.	Ascent in mms. in tube 1 mm. radius.	Ascent in ·01's in. in tube ·01 in. radius.	Ascent in mms. in tube 1 mm. radius.	Ascent in ·01's in. in tube ·01 in. radius.	Ascent in mms. in tube 1 mm. radius.	Ascent in ·01's in. in tube ·01 in. radius.	Ascent in mms. in tube 1 mm. radius.	Ascent in ·01's in. in tube ·01 in. radius.
0°	15·4084	238·835	6·0618	93·959	6·949	107·712	6·629	102·752	5·274	81·749	5·433	84·215
1	3801	396	0475	738	925	346	603	355	263	585	407	83·814
2	3518	237·957	0332	516	902	106·980	578	101·958	253	422	381	413
3	3235	518	0189	295	878	614	552	561	242	258	356	013
4	2951	079	0046	074	855	248	527	164	232	095	330	82·612
5	2668	236·640	5·9904	92·853	831	105·883	501	100·768	221	80·931	304	211
6	2385	201	9761	631	807	517	475	371	211	767	278	81·810
7	2102	235·763	9618	410	784	151	450	99·974	200	604	252	410
8	1819	324	9475	189	760	104·785	424	577	190	440	226	009
9	1535	234·885	9333	91·968	737	419	399	180	179	277	200	80·608
10	1252	446	9190	746	713	054	373	98·783	169	113	175	207
11	0969	007	9047	525	689	103·688	347	387	158	79·950	149	79·807
12	0686	233·568	8904	304	666	322	322	97·990	147	786	123	406
13	0403	129	8762	083	642	102·956	296	593	137	623	097	005
14	0119	232·690	8619	90·861	619	590	271	196	126	459	071	78·605
15	14·9836	251	8476	640	595	225	245	96·799	116	296	045	204
16	9553	231·812	8333	419	571	101·859	219	403	105	132	019	77·803
17	9270	373	8191	197	548	493	194	006	095	78·969	4·994	402
18	8987	230·934	8048	89·976	524	127	168	95·609	084	805	968	002
19	8703	495	7905	755	501	100·761	142	212	074	642	942	76·601
20	8420	056	7762	534	477	396	117	94·815	063	478	916	200
21	8137	229·617	7620	312	453	030	091	418	052	315	890	75·799
22	7854	178	7477	091	430	99·664	066	022	042	151	864	399
23	7571	228·739	7334	88·870	406	298	040	93·625	031	77·987	838	74·998
24	7287	300	7191	649	383	98·932	014	228	021	824	813	597

25	7004	227·861	7049	427	359	567	5·989	92·831	010	660	787	196
26	6721	422	6906	206	335	201	963	434	000	497	761	73·796
27	6438	226·983	6763	87·985	312	97·835	938	038	4·989	333	735	395
28	6155	544	6620	764	288	469	912	91·641	979	170	709	72·994
29	5871	105	6478	542	265	103	886	244	968	006	683	594
30	5588	225·666	6335	321	241	96·738	861	90·847	958	76·843	658	193
31	5305	227	6192	100	217	372	835	450	947	679	632	71·792
32	5022	224·788	6049	86·878	194	006	810	054	936	516	606	391
33	4739	349	5907	657	170	95·640	784	89·657	926	352	580	70·991
34	4455	223·910	5764	436	147	274	758	260	915	189	554	590
35	4172	471	5621	215	123	94·909	733	88·863	905	025	528	189
36	3889	032	5478	85·993	099	543	707	466	894	75·862		
37	3606	222·593	5336	772	076	177	682	069	884	698		
38	3323	154	5193	551	052	93·811	656	87·673	873	535		
39	3039	221·716	5050	330	029	445	630	276	863	371		
40	2756	277	4907	108	005	080	605	86·879	852	207		
41	2473	220·838	4765	84·887	5·981	92·714	579	482	841	044		
42	2190	399	4622	666	958	348	554	086	831	74·880		
43	1907	219·960	4479	445	934	91·982	528	85·689	820	717		
44	1623	521	4337	223	911	616	503	292	810	553		
45	1340	082	4194	002	887	250	477	84·895	799	390		
46	1057	218·643	4051	83·781	863	90·885	451	498	789	226		
47	0774	204	3908	559	840	519	426	101				
48	0491	217·765	3766	338	816	153	400	83·705				
49	0207	326	3623	117	793	89·787	375	308				
50	13·9924	216·887	3480	82·896	769	421	349	82·911				
51	9641	448	3337	674	745	056	323	514				
52	·9358	009	3195	453	722	88·690	298	117				
53	9075	215·570	3052	231	698	324	272	81·721				
54	8791	131	2909	011	675	87·958	247	324				
55	8508	214·692	2766	81·789	651	592	221	80·927				
56	8225	253	2624	568	627	227	195	530				
57	7942	213·814	2481	347	604	86·861						

TABLE LXXIa.—*continued.*

t° C.	Water.		Alcohol.		Benzol.		Acetone.		Carbon Disulphide.		Ether.	
	Ascent in mms. in tube 1 mm. radius.	Ascent in ·01's in. in tube ·01 in. radius.	Ascent in mms. in tube 1 mm. radius.	Ascent in ·01's in. in tube ·01 in. radius.	Ascent in mms. in tube 1 mm. radius.	Ascent in ·01's in. in tube ·01 in. radius.	Ascent in mms. in tube 1 mm. radius.	Ascent in ·01's in. in tube ·01 in. radius.	Ascent in mms. in tube 1 mm. radius.	Ascent in ·01's in. in tube ·01 in. radius.	Ascent in mms. in tube 1 mm. radius.	Ascent in ·01's in. in tube ·01 in. radius.
58°	13·7659	213·375	5·2338	81·126	5·580	86·495						
59	7375	212·936	2195	80·904	557	129						
60	7092	497	2053	683	533	85·764						
61	6809	058	1910	462	509	398						
62	6526	211·619	1767	240	486	032						
63	6243	180	1624	019	462	84·666						
64	5959	210·741	1482	79·798	439	300						
65	5676	302	1339	577	415	83·934						
66	5393	209·863	1196	355	391	569						
67	5110	424	1053	134	368	203						
68	4827	208·985	0911	78·913	344	82·837						
69	4543	546	0768	692	321	471						
70	4260	107	0625	470	297	106						
71	3977	207·669	0482	249	273	81·740						
72	3694	230	0340	028	250	374						
73	3411	206·791	0197	77·807	226	008						
74	3127	352	0054	585	203	80·642						
75	2844	205·913	4·9911	364	179	276						
76	2561	474	9769	143	155	79·911						
77	2278	035	9626	76·921	132	545						
78	1995	204·596	9483	700	108	179						
79	1711	157			085	78·813						
80	1428	203·718			061	447						
81	1145	279										
82	0862	202·840										

83	0579	401
84	0295	201·962
85	0012	523
86	12·9729	084
87	9446	200·645
88	9163	206
89	8879	199·767
90	8596	328
91	8313	198·889
92	8030	450
93	7747	011
94	7463	197·572
95	7180	133
96	6897	196·694
97	6614	255
98	6331	195·816
99	6047	377
100	5764	194·938

TABLE LXXIB.—**Capillarity Constants of Water, Alcohol, Benzol, Acetone, Carbon Disulphide, and Ether.**
Fahrenheit Scale. (J. C.-E.)

$t°$ F.	Water.		Alcohol.		Benzol.		Acetone.		Carbon Disulphide.		Ether.	
	Ascent in mms. in tube 1 mm. radius.	Ascent in ·01's in. in tube ·01 in. radius.	Ascent in mms. in tube 1 mm. radius.	Ascent in ·01's in. in tube ·01 in. radius.	Ascent in mms. in tube 1 mm. radius.	Ascent in ·01's in. in tube ·01 in. radius.	Ascent in mms. in tube 1 mm. radius.	Ascent in ·01's in. in tube ·01 in. radius.	Ascent in mms. in tube 1 mm. radius.	Ascent in ·01's in. in tube ·01 in. radius.	Ascent in mms. in tube 1 mm. radius.	Ascent in ·01's in. in tube ·01 in. radius.
32°	15·4084	238·835	6·0618	93·959	6·949	107·712	6·629	102·752	5·274	81·749	5·433	84·215
33	3927	591	0538	836	936	508	615	531	268	658	419	83·992
34	3769	348	0459	713	923	305	601	310	262	567	404	769
35	3612	104	0380	590	910	102	586	090	256	476	390	547
36	3455	237·860	0300	467	897	106·899	572	101·870	251	385	376	324
37	3297	616	0221	344	883	696	558	649	245	294	361	102
38	3140	372	0142	221	870	492	544	429	239	204	347	82·879
39	2983	128	0062	099	857	289	529	208	233	113	333	656
40	2825	236·884	5·9983	92·976	844	086	515	100·988	227	022	318	434
41	2668	640	9904	853	831	105·883	501	768	221	80·931	304	211
42	2511	397	9824	730	818	679	487	547	215	840	289	81·988
43	2353	153	9745	607	805	476	473	327	210	749	275	766
44	2196	235·909	9666	484	792	273	458	106	204	658	261	543
45	2039	665	9587	361	779	070	444	99·886	198	568	246	321
46	1881	421	9507	238	765	104·866	430	665	192	477	232	098
47	1724	177	9428	115	752	663	416	445	186	386	218	80·875
48	1567	234·933	9349	91·992	739	460	401	224	180	295	203	653
49	1409	690	9269	869	726	257	387	004	174	204	189	430
50	1252	446	9190	746	713	054	373	98·783	169	113	175	207
51	1095	202	9111	623	700	103·850	359	563	163	022	160	79·985
52	0937	233·958	9031	500	687	647	345	343	157	79·932	146	762
53	0780	714	8952	378	674	444	330	122	151	841	131	540
54	0623	470	8872	255	661	241	316	97·902	145	750	117	317
55	0465	226	8793	132	647	037	302	681	139	659	103	094
56	0308	232·982	8714	009	634	102·834	288	461	133	568	088	78·872

57	0151	739	8635	90·886	621	631	273	240	127	477	074	649
58	14·9993	495	8556	763	608	428	259	020	122	387	060	426
59	9836	251	8476	640	595	225	245	96·799	116	296	045	204
60	9679	007	8397	517	582	021	231	579	110	205	031	77·981
61	9521	231·763	8318	394	569	101·818	217	359	104	114	017	759
62	9364	519	8238	271	556	615	202	138	098	023	002	536
63	9207	275	8159	148	543	412	188	95·918	092	78·932	4·988	313
64	9049	031	8080	025	529	208	174	697	086	841	973	091
65	8892	230·788	8000	89·902	516	005	160	477	081	750	959	76·868
66	8735	544	7921	780	503	100·802	145	256	075	660	945	645
67	8578	300	7842	657	490	599	131	036	069	569	930	423
68	8420	056	7762	534	477	396	117	94·815	063	478	916	200
69	8263	229·812	7683	411	464	192	103	595	057	387	902	75·978
70	8105	568	7604	288	451	99·989	089	374	051	296	887	755
71	7948	324	7525	165	438	786	074	154	045	206	873	532
72	7791	080	7445	042	425	583	060	93·934	040	115	859	310
73	7633	228·837	7366	88·919	411	379	046	713	034	024	844	087
74	7476	593	7287	796	398	176	032	493	028	77·933	830	74·864
75	7319	349	7207	673	385	98·973	017	272	022	842	815	642
76	7162	105	7128	550	372	769	003	052	016	751	801	419
77	7004	227·861	7049	427	359	566	5·989	92·831	010	660	787	196
78	6847	617	6969	304	346	363	975	611	004	570	772	73·974
79	6690	373	6890	181	333	160	961	390	4·999	479	758	751
80	6532	130	6811	059	320	97·956	946	170	993	388	744	529
81	6375	226·886	6732	87·936	307	753	932	91·950	987	297	729	306
82	6218	642	6652	813	293	550	918	729	981	206	715	083
83	6060	398	6573	690	280	347	904	509	975	115	701	72·861
84	5903	154	6494	567	267	143	889	288	969	024	686	638
85	5746	225·910	6414	444	254	96·940	875	068	963	76·934	672	415
86	5588	666	6335	321	241	737	861	90·847	957	843	658	193
87	5431	422	6256	198	228	534	847	627	952	752	643	71·970
88	5274	179	6176	075	215	331	833	406	946	661	629	748
89	5116	224·935	6097	86·952	202	128	818	186	940	570	614	525

TABLE LXXIb.—*continued.*

t° F.	Water.		Alcohol.		Benzol.		Acetone.		Carbon Disulphide.		Ether.	
	Ascent in mms. in tube 1 mm. radius.	Ascent in ·01's in. in tube ·01 in. radius.	Ascent in mms. in tube 1 mm. radius.	Ascent in ·01's in. in tube ·01 in. radius.	Ascent in mms. in tube 1 mm. radius.	Ascent in ·01's in. in tube ·01 in. radius.	Ascent in mms. in tube 1 mm. radius.	Ascent in ·01's in. in tube ·01 in. radius.	Ascent in mms. in tube 1 mm. radius.	Ascent in ·01's in. in tube ·01 in. radius.	Ascent in mms. in tube 1 mm. radius.	Ascent in ·01's in. in tube ·01 in. radius.
90°	14·4959	224·691	5·6018	86·829	6·189	95·924	5·804	89·965	4·934	76·479	4·600	71·302
91	4802	447	5938	706	175	721	790	745	928	389	586	080
92	4644	203	5859	583	162	518	776	525	922	298	571	70·857
93	4487	223·959	5780	461	149	315	761	304	916	207	557	634
94	4329	715	5701	338	136	112	747	084	911	116	543	412
95	4172	471	5621	215	123	94·909	733	88·863	905	025	528	189
96	4015	228	5542	092	110	705	719	643	899	75·934		
97	3858	222·984	5463	85·969	097	502	705	422	893	843		
98	3700	740	5383	846	084	298	690	202	887	753		
99	3543	496	5304	723	071	095	676	87·981	881	662		
100	3386	252	5225	600	057	93·892	662	761	875	571		
101	3228	008	5145	477	044	689	648	541	869	480		
102	3071	221·764	5066	354	031	486	633	320	864	389		
103	2914	520	4987	231	018	283	619	100	858	298		
104	2756	277	4907	108	005	080	605	86·879	852	208		
105	2599	033	4828	84·985	5·992	92·876	591	659	846	117		
106	2442	220·789	4749	862	979	673	577	438	840	026		
107	2284	545	4670	740	966	469	562	218	834	74·935		
108	2127	301	4590	617	953	266	548	85·997	828	844		
109	1970	057	4511	494	939	063	534	777	823	753		
110	1812	219·813	4432	371	926	91·860	520	556	817	662		
111	1655	569	4352	248	913	656	505	336	811	572		
112	1497	326	4273	125	900	453	491	116	805	481		
113	1340	082	4194	002	887	250	477	84·895	799	390		
114	1183	218·838	4114	83·879	874	047	463	675	793	299		

115	1025	594	4035	756	861	90·844	449	454
116	0868	350	3956	633	848	640	434	234
117	0711	106	3876	510	835	437	420	013
118	0553	217·862	3797	387	821	234	406	83·793
119	0396	618	3718	264	808	031	392	572
120	0239	375	3639	142	795	89·827	377	352
121	0081	131	3559	019	782	624	363	132
122	13·9924	216·887	3480	82·896	769	421	349	82·911
123	9767	643	3401	773	756	218	335	691
124	9609	399	3321	650	743	014	321	470
125	9452	155	3242	527	730	88·811	306	250
126	9295	215·911	3163	404	717	608	292	029
127	9137	667	3083	281	703	405	278	81·809
128	8980	424	3004	158	690	202	264	588
129	8823	180	2925	035	677	87·998	249	368
130	8665	214·936	2846	81·912	664	795	235	147
131	8508	692	2766	789	651	592	221	80·927
132	8351	448	2687	666	638	389	207	707
133	8193	204	2608	543	625	185		
134	8036	213·960	2528	421	612	86·982		
135	7879	717	2449	298	599	779		
136	7721	473	2370	175	585	576		
137	7564	229	2290	052	572	373		
138	7407	212·985	2211	80·929	559	170		
139	7249	741	2132	806	546	85·967		
140	7092	497	2052	683	533	764		
141	6935	253	1973	560	520	560		
142	6777	009	1894	437	507	357		
143	6620	211·766	1815	314	494	154		
144	6463	522	1735	191	481	84·951		
145	6305	278	1656	068	467	747		
146	6148	034	1577	79·945	454	544		
147	5991	210·790	1497	822	441	341		

TABLE LXXIB.—*continued.*

	mms. in tube 1 mm. radius.	·01's in. in tube ·01 in. radius.	mms. in tube 1 mm. radius.	·01's in. in tube ·01 in. radius.	mms. in tube 1 mm. radius.	·01's in. in tube ·01 in. radius.	Ascent in mms. in tube 1 mm. radius.	Ascent in ·01's in. in tube ·01 in. radius.	Ascent in mms. in tube 1 mm. radius.	Ascent in ·01's in. in tube ·01 in. radius.	Ascent in mms. in tube 1 mm. radius.	Ascent in ·01's in. in tube ·01 in. radius.
148°	13·5833	210·546	5·1418	79·700	5·428	84·138						
149	5676	302	1339	577	415	83·934						
150	5519	058	1259	454	402	731						
151	5361	209·815	1180	331	389	528						
152	5204	571	1101	208	376	325						
153	5047	327	1021	085	363	122						
154	4889	083	0942	78·962	349	82·919						
155	4732	208·839	0863	839	336	715						
156	4575	595	0784	716	323	512						
157	4417	351	0704	593	310	309						
158	4260	107	0625	470	297	106						
159	4103	207·864	0546	347	284	81·903						
160	3945	620	0466	224	371	699						
161	3788	376	0387	102	258	496						
162	3631	132	0308	77·979	245	292						
163	3473	206·888	0228	856	231	089						
164	3316	644	0149	733	218	80·886						
165	3159	400	0070	610	205	683						
166	3001	156	4·9990	487	192	480						
167	2844	205·913	9911	364	179	276						
168	2687	669	9832	241	166	072						
169	2530	425	9753	118	153	79·869						
170	2372	181	9673	76·995	140	666						
171	2215	204·937	9594	872	127	463						
172	2058	693	9515	749	113	259						

173	1900	449			100	056						
174	1743	206			087	78·853						
175	1586	203·962			074	650						
176	1428	718			061	447						
177	1271	474										
178	1114	230										
179	0956	202·986										
180	0799	742										
181	0642	498										
182	0484	255										
183	0327	011										
184	0170	201·767										
185	0012	523										
186	12·9855	279										
187	9698	035										
188	9540	200·791										
189	9383	547										
190	9226	304										
191	9068	060										
192	8911	199·816										
193	8754	572										
194	8596	328										
195	8439	084										
196	8282	198·840										
197	8124	596										
198	7967	353										
199	7810	109										
200	7652	197·865										
201	7495	621										
202	7338	377										
203	7180	133										
204	7023	196·889										
205	6866	646										

t° F.	Ascent in mms. in tube 1 mm. radius.	Ascent in ·01's in. in tube ·01 in. radius.	Ascent in mms. in tube 1 mm. radius.	Ascent in ·01's in. in tube ·01 in. radius.	Ascent in mms. in tube 1 mm. radius.	Ascent in ·01's in. in tube ·01 in. radius.	Ascent in mms. in tube 1 mm. radius.	Ascent in ·01's in. in tube ·01 in. radius.	Ascent in mms. in tube 1 mm. radius.	Ascent in ·01s in. in tube ·01 in. radius.	Ascent in mms. in tube 1 mm. radius.	Ascent in ·01's in. in tube ·01 in. radius.
206°	12·6708	196·402										
207	6551	158										
208	6394	195·914										
209	6236	670										
210	6079	426										
211	5922	182										
212	5764	194·938										

TABLE LXXIc.—**Surface Tension. Values of a.** (J. C.-E.)

t° C.	Water.		Alcohol.		Ether.		Benzol.	
	Mgms. per mm.	Dynes per cm.	Mgms. per mm.	Dynes per cm.	Mgms. per mm.	Dynes per cm.	Mgms. per mm.	Dynes per cm.
0°	7·9225	77·74	2·569	25·21	1·982	19·45	3·141	30·82
1	9054	57	559	11	970	34	129	70
2	8883	40	550	02	959	22	116	57
3	8711	24	541	24·93	947	10	103	45
4	8539	07	531	84	935	18·99	090	33
5	8367	76·90	522	74	923	87	078	20
6	8195	73	512	65	912	76	065	08
7	8022	56	503	56	900	64	053	29·95
8	7848	39	493	47	888	53	040	83
9	7675	22	484	37	876	41	027	70
10	7501	05	474	28	865	30	015	58
11	7326	75·88	465	19	853	18	002	45
12	7151	70	456	09	841	06	2·989	33
13	6976	53	446	00	829	17·95	977	21
14	6801	36	437	23·91	817	83	964	08
15	6625	19	427	82	806	72	951	28·96
16	6449	02	418	72	794	60	938	83
17	6273	74·84	408	63	782	49	926	71
18	6096	67	399	54	770	37	913	58
19	5919	50	389	45	759	26	900	46
20	5741	32	380	35	747	14	888	33
21	5564	15	370	26	735	03	875	21
22	5385	73·97	361	17	723	16·91	862	09
23	5207	80	352	07	712	79	850	27·96
24	5028	62	342	22·98	700	68	837	84
25	4849	45	333	89	688	56	824	71
26	4669	27	323	80	676	45	812	59
27	4489	09	314	70	664	33	799	46
28	4309	72·92	304	61	653	22	786	34
29	4128	74	295	52	641	10	774	22
30	3947	56	285	43	629	15·99	761	09
31	3766	38	276	33	617	87	748	26·97
32	3584	20	267	24	606	75	736	84
33	3402	03	257	15	594	64	723	72
34	3220	71·85	248	05	582	52	710	59
35	3037	67	238	21·96	570	41	698	47
36	2854	49	229	87			685	34

TABLE LXXIc.—*continued.*

t° C.	Water.		Alcohol.		Ether.		Benzol.	
	Mgms. per mm.	Dynes per cm.	Mgms. per mm.	Dynes per cm.	Mgms. per mm.	Dynes per cm.	Mgms. per mm.	Dynes per cm.
37°	7·2671	71·31	2·219	21·78			2·672	26·22
38	2487	13	210	68			660	10
39	2303	70·95	200	59			647	25·97
40	2119	77	191	50			634	85
41	1934	59	181	41			621	72
42	1749	40	172	31			609	60
43	1563	22	163	22			596	47
44	1377	04	153	13			583	35
45	1191	69·86	144	03			571	22
46	1005	67	134	20·94			558	10
47	0818	49	125	85			545	24·98
48	0630	31	115	76			533	85
49	0443	12	106	66			520	73
50	0255	68·94	096	57			507	60
51	0067	75	087	48			495	48
52	6·9878	57	078	39			482	35
53	9689	38	068	29			470	23
54	9500	20	059	20			457	11
55	9310	01	049	11			444	23·98
56	9120	67·82	040	01			431	86
57	8930	64	030	19·92			418	73
58	8739	45	021	83			406	61
59	8548	26	011	74			393	48
60	8357	07	002	64			381	36
61	8165	66·89	1·992	55			368	23
62	7973	70	983	46			355	11
63	7780	51	973	37			343	22·99
64	7587	32	964	27			330	86
65	7394	13	955	18			317	74
66	7201	65·94	945	09			304	61
67	7007	75	936	18·99			292	49
68	6813	56	926	90			279	36
69	6618	37	917	81			266	24
70	6423	18	907	72			254	11
71	6228	64·99	898	62			241	21·99
72	6033	79	889	53			228	87
73	5837	60	879	44			216	74

TABLE LXXIc.—*continued.*

$t°$ C.	Water.		Alcohol.		Ether.		Benzol.	
	Mgms. per mm.	Dynes per cm.	Mgms. per mm.	Dynes per cm.	Mgms per mm.	Dynes per cm.	Mgms. per mm.	Dynes per cm.
74°	6·5640	64·41	1·870	18·35			2·203	21·62
75	5444	22	860	25			190	49
76	5247	02	851	16			178	37
77	5049	63·83	841	07			165	24
78	4852	64	832	17·97			152	12
79	4654	44					140	00
80	4455	25					127	20·87
81	4257	05						
82	4058	62·86						
83	3858	66						
84	3658	46						
85	3458	27						
86	3258	07						
87	3057	61·87						
88	2856	68						
89	2654	48						
90	2453	28						
91	2250	08						
92	2048	60·88						
93	1845	69						
94	1642	49						
95	1438	29						
96	1234	09						
97	1030	59·89						
98	0825	68						
99	0620	48						
100	0415	28						

TABLE LXXId.—**Surface Tension. Values of** a. (J. C.-E.)

t° F.	Water.		Alcohol.		Ether.		Benzol.	
	Mgms. per mm.	Dynes per cm.	Mgms. per mm.	Dynes per cm.	Mgms. per mm.	Dynes per cm.	Mgms. per mm.	Dynes per cm.
32°	7·9225	77·74	2·569	25·21	1·982	19·45	3·141	30·82
33	9132	65	563	16	976	39	134	75
34	9037	55	558	11	969	32	127	68
35	8941	46	553	06	963	26	120	62
36	8846	37	547	01	956	19	113	55
37	8750	27	542	24·95	950	13	106	48
38	8655	18	537	90	943	07	099	41
39	8559	09	532	85	936	00	092	34
40	8463	76·99	527	79	930	18·93	085	27
41	8367	90	522	74	923	87	078	20
42	8272	80	516	69	917	81	071	13
43	8177	71	511	64	910	75	064	06
44	8081	62	506	58	904	68	057	29·99
45	7985	52	500	53	897	62	050	92
46	7888	43	495	48	891	55	043	86
47	7791	33	490	43	884	49	036	79
48	7694	24	484	38	878	42	029	72
49	7598	14	479	33	871	36	022	65
50	7501	05	474	28	865	30	015	58
51	7405	75·95	469	22	858	23	007	51
52	7308	86	464	17	851	17	000	44
53	7211	76	458	12	845	10	2·993	37
54	7114	67	453	07	838	04	986	30
55	7016	57	448	02	832	17·98	979	23
56	6919	48	442	23·97	825	91	972	16
57	6821	38	437	92	819	85	965	09
58	6723	28	432	87	812	78	958	03
59	6625	19	427	82	806	72	951	28·96
60	6528	09	422	76	799	65	944	89
61	6431	00	416	71	793	59	937	82
62	6333	74·90	411	66	786	53	930	75
63	6235	80	406	61	780	46	923	68
64	6136	71	401	55	773	40	916	61
65	6038	61	395	50	766	33	909	54
66	5939	51	390	45	760	27	902	47
67	5840	42	385	40	753	21	895	40
68	5741	32	380	35	747	14	888	33

TABLE LXXId.—*continued.*

t° F.	Water. Mgms. per mm.	Water. Dynes per cm.	Alcohol. Mgms. per mm.	Alcohol. Dynes per cm.	Ether. Mgms. per mm.	Ether. Dynes per cm.	Benzol. Mgms. per mm.	Benzol. Dynes per cm.
69°	7·5643	74·22	2·375	23·30	1·740	17·08	2·881	28·27
70	5545	13	369	25	734	01	874	20
71	5446	03	364	19	727	16·95	867	13
72	5347	73·93	359	14	721	88	860	06
73	5247	84	354	09	714	82	853	27·99
74	5148	74	348	04	708	76	845	92
75	5048	64	343	22·99	701	69	838	85
76	4949	54	338	94	695	63	831	78
77	4849	45	333	89	688	56	824	71
78	4751	35	327	84	681	50	817	64
79	4651	25	322	78	675	44	810	57
80	4551	15	317	73	668	37	803	51
81	4450	05	311	68	662	31	796	44
82	4350	72·96	306	63	655	24	789	37
83	4249	86	301	58	649	18	782	30
84	4149	76	296	53	642	11	775	23
85	4048	66	290	48	636	05	768	16
86	3947	56	285	43	629	15·99	761	09
87	3847	46	280	37	623	92	754	02
88	3747	36	274	32	616	86	747	26·95
89	3646	26	269	27	610	79	740	88
90	3545	17	264	22	603	73	733	81
91	3444	07	259	17	596	67	726	75
92	3342	71·97	253	12	590	60	719	68
93	3241	87	248	07	583	54	712	61
94	3139	77	243	01	577	47	705	54
95	3037	67	238	21·96	570	41	698	47
96	2937	57	232	91			690	40
97	2835	47	227	86			683	33
98	2733	37	222	81			676	26
99	2631	27	217	75			669	19
100	2529	17	212	70			662	12
101	2426	07	206	65			655	05
102	2324	70·97	201	60			648	25·98
103	2221	87	196	55			641	92
104	2119	77	191	50			634	85
105	2017	67	186	44			627	78

TABLE LXXID.—*continued.*

t° F.	Water.		Alcohol.		Ether.		Benzol.	
	Mgms. per mm.	Dynes per cm	Mgms. per mm.	Dynes per cm.	Mgms. per mm.	Dynes per cm.	Mgms. per mm.	Dynes per cm.
106°	7·1915	70·56	2·180	21·39			2·620	25·71
107	1812	46	175	34			613	64
108	1709	36	170	29			606	57
109	1605	26	165	24			599	50
110	1502	16	160	19			592	43
111	1398	06	154	13			585	36
112	1295	69·96	149	08			578	29
113	1191	86	144	03			571	22
114	1088	75	139	20·98			564	16
115	0985	65	133	93			557	09
116	0881	55	128	87			550	02
117	0777	45	123	82			543	24·95
118	0673	35	118	77			536	88
119	0569	24	112	72			528	81
120	0464	14	107	67			521	74
121	0360	04	102	62			514	67
122	0255	68·94	096	57			507	60
123	0152	84	091	52			500	53
124	0047	73	085	46			493	46
125	6·9942	63	080	41			486	40
126	9837	53	075	36			479	33
127	9732	42	069	31			472	26
128	9627	32	064	26			465	19
129	9521	22	059	21			458	12
130	9416	11	054	16			451	05
131	9310	01	049	11			444	23 98
132	9206	67·91	043	05			437	91
133	9101	80	038	00			430	84
134	8994	70	033	19·95			423	77
135	8888	60	028	90			416	70
136	8782	49	022	84			409	64
137	8676	39	017	79			402	57
138	8569	28	012	74			395	50
139	8463	18	007	69			388	43
140	8357	07	002	64			381	36
141	8251	66·97	1·996	59			373	29
142	8145	87	991	53			366	22

TABLE LXXID.—*continued.*

t° F.	Water.		Alcohol.		Ether.		Benzol.	
	Mgms. per mm.	Dynes per cm.	Mgms. per mm.	Dynes per cm.	Mgms. per mm.	Dynes per cm.	Mgms. per mm.	Dynes per cm.
143°	6·8039	66·76	1·986	19·48			2·359	23·15
144	7932	. 66	981	43			352	08
145	7825	55	975	38			345	01
146	7718	45	970	33			338	22·94
147	7610	34	965	28			331	87
148	7502	24	960	23			324	81
149	7394	13	955	18			317	74
150	7287	02	949	12			310	67
151	7179	65·92	944	07			303	60
152	7071	81	939	02			296	53
153	6963	71	933	18·97			289	46
154	6855	60	928	92			282	39
155	6747	50	923	87			275	32
156	6639	39	918	82			268	25
157	6531	28	912	77			261	18
158	6423	18	907	72			254	11
159	6314	07	902	66			247	05
160	6206	64·97	897	61			240	21·98
161	6097	86	891	56			233	91
162	5988	75	886	51			226	84
163	5879	64	881	46			219	77
164	5777	54	876	40			211	70
165	5662	43	870	35			204	63
166	5553	32	865	30			197	56
167	5444	22	860	25			190	49
168	5334	11	854	20			183	42
169	5224	00	849	15			176	35
170	5115	63·89	844	10			169	29
171	5005	79	839	05			162	22
172	4895	68	833	17·99			155	15
173	4785	57					148	08
174	4675	46					141	01
175	4565	36					134	20·94
176	4455	25					127	87
177	4344	63·14						
178	4234	03						
179	4123	62·93						

TABLE LXXID.—*continued.*

t° F.	Water.		Alcohol.		Ether.		Benzol.	
	Mgms. per mm.	Dynes per cm.	Mgms. per mm.	Dynes per cm.	Mgms. per mm.	Dynes per cm.	Mgms. per mm.	Dynes per cm.
180°	6·4012	62·82						
181	3901	71						
182	3790	60						
183	3679	49						
184	3569	38						
185	3458	27						
186	3347	16						
187	3235	05						
188	3123	61·94						
189	3011	83						
190	2900	72						
191	2788	61						
192	2676	50						
193	2565	39						
194	2453	28						
195	2340	17						
196	2227	06						
197	2114	60·95						
198	2002	84						
199	1889	73						
200	1776	62						
201	1664	51						
202	1551	40						
203	1438	29						
204	1324	17						
205	1211	06						
206	1097	59·95						
207	0983	84						
208	0870	72						
209	0756	61						
210	0642	50						
211	0529	39						
212	0415	28						

TABLE LXXIE.—**Capillarity Constants of Various Liquids.**

Name.	Formula.	$t°$ C.	a^2.	Values of a: In Mgms. per mm.	Values of a: In Dynes per cm.	Method.	Authority.
Water, ...	H_2O	8·5	15·13				Gay Lussac
		11	15·03				,,
		16	14·524				,,
		0	15·42			Tubes	Frankenheim
		0	15·523			,,	Sondhauss
		10	14·878			,,	Hagen
		0	15·3321				Brunner
		15	14·70				Quincke
		16·2	14·47	7·235	71·02	Tubes	,,
		25		8·235	80·83	Bubbles	,,
				8·365	82·08		,,
				7·881	77·33		,,
				8·253	80·98	Films	,,
		18		8·375	82·17		,,
		0		8·708	85·44		,,
		18		7·881–8·415	77·33–82·57	Bubbles	,, ,,
		0		8·207–8·749	80·53–85·84	,,	,, ,,
		18		7·35	72·12	Tubes	,,
		0		7·642	74·98	,,	,,
		18		6·259	61·41	Falling Drops	,,
		0		6·508	63·86	,,	,,
		12·5	14·82			Drops	Duprez
				7·30	71·66		Plateau
		18		7·945	77·96	GlassPlates	Wilhelmy

TABLE LXXIE.—*continued.*

Name.	Formula.	t° C.	a^2.	Values of α: In Mgms. per mm.	Values of α: In Dynes per cm.	Method.	Authority.
Water, ...	H_2O	0°		8·260	81·05	GlassPlates	Wilhelmy
		18		7·35	72·12	Jets	Rayleigh
		0		7·64	74·96	,,	,,
		3·2	14·1827				Scholz
		4·0	14·0612				,,
		0	15·81				Braun
		18		7·878	77·30	Bubbles	Timberg
		0		8·204	80·50	,,	,,
		18		7·831	76·84	Adhesion to Pt.	,,
		0		8·236	80·81	,,	,,
		18		7·65	75·06	Pulsating Drops	Lenard
		0		7·954	78·04	,,	,,
		18		7·594	74·41	Ripples	Rayleigh
		0		7·896	77·48	,,	,,
		17·5	14·64			Tubes	Rodenbeck
		16	14·53			,,	Volkmann
		15	14·714			,,	Rother
		15	14·77			,,	Traube
		8·9	15·09			,,	Schiff
		19·25	14·453	7·226	70·93	Drops	Magie
		20 (circ.)	14·99			Bubbles	,,
		18		7·234	70·98	Tubes	,,
		0		7·528	73·86	,,	,,
		18		7·83	76·83	Adhesion to Cu	Weinberg
		0		8·16	80·07	,,	,,

		18		7·437	72·97	Raised Films	Proctor Hall
		0		7·695	75·50	,,	,,
		20	14·61	7·305	71·71	,,	Sieg
		0		7·683	75·40		Volkmann
		2·5		7·653	75·11		,,
		5		7·623	74·82		,
		6		7·602	74·61		,,
		7·5		7·580	74·39		,,
		10		7·543	74·03		,,
		12·5		7·506	73·67		,,
		17		7·469	73·30		,, •
		17·5		7·432	72·94		,,
		20		7·395	72·57		,,
		22·5		7·356	72·20		,,
		25		7·317	71·81		,,
		30		7·236	71·02		,,
		35		7·15	70·2		,,
		40		7·08	69·5		,,
		18		7·5	73·59	Ripples	Grunmach
		18		7·4	72·61	Tubes	,,
		20 (circ.)		7·26	71·24		Kasterin
		9		8·028	78·77		Timberg
		9		7·995	78·45		,,
		13·5		7·44	73·035		Jäger
				7·376	72·37		Cantor
		18		7·46	73·24	Ripples	Dorsey
		0		7·74	75·98	,,	
		0		7·809	76·62	,,	Watson
Distilled tap, . . .		0		7·908	77·59	,,	,,
		0		7·791	76·45	,,	,,
Mercury, ...	Hg			57·52	564·37		Morveau
				44·05	432·21	Drops	Laplace
.		12·8		44·21	433·78	,,	Poisson
		0		40·50	397·38		Frankenheim
		0		39·78	390·31		,,

TABLE LXXIe.—*continued.*

Name.	Formula.	t° C.	a^2.	Values of a In Mgms. per mm.	Values of a In Dynes per cm.	Method.	Authority.
Mercury, ...	Hg	°		41·13	403·56	Falling Drops	Hagen
				45·47	446·14	Drops	Danger
				46·55	456·74	„	Desain
				45·96	450·95	„	„
		16·5		53·1	521·01	„	Quincke
		18·6		40·42–57·06	396·59–559·86	Falling Drops	„
				49·17	482·45	„	Duprè
				49·1	481·76	Adhesion Rings	Mensbrugghe
		20		55·03	539·94	Bubbles	Quincke
				50–55	490·59–539·65	Adhesion Rings	Sondhauss
		0		35·785	351·115	Bubbles	Scholz
		20		31·209	306·216	„	„
		33·5		30·486	299·122	„	„
				34	333·60	Drops	Bashforth
		20		45·82	449·58	Curvature of Drops	Magie
				47·10	462·13	Pulsating Drops	Lenard
				46·44	455·66	Drops	Sieg
				49·6	486·66	Ripples	Mathiessen
				39·23	384·92	Floating Plates	Sentis
				50	490·59		Riccard
				53·93	529·15	Ripples	Smith

				45·85	449·87	Manometer	Cantor
				55·78	547·30	Tubes	Quincke
				43·68	428·58	Curvature of Drops	G. Meyer
		16		45·40	445·45	„	Siedentopf
		20		47·75	468·51	Drops	Quincke
				51·5	505·31	„	G. Meyer
		17		48·5	475·87	„	Stöckle
		17		43·7	428·78	„	„
		17		44·43	435·94	„	Gradenwitz
		20		44·75	439·07	Ripples	Watson
		20		49·63	487·04	„	„
Bromine,	Br_2	0	2·9254				Schiff
		−21	3·895				Quincke
Carbon disulphide,	CS_2	0	5·10				Frankenheim
		46·5	4·747				Schiff
				3·274	32·14	Tubes	Quincke
Tetrachlor-ethylene,	C_2Cl_4	120	2·855			„	Schiff
Carbon tetrachloride,	CCl_4	7·4	3·6005			„	„
		75·2		2·04	20·03	„	„
Silicon tetrachloride,	$SiCl_4$	0	3·0097			„	Mendelejeff
Stannic chloride,	$SnCl_4$	19·5		2·712	26·62	„	
Sulphur „	S_2Cl_2	19·5		4·747	46·60		
Phosphorus trichloride,	PCl_3	0	4·050			Tubes	Schiff
		75·4	3·017			„	„
		15		3·042	29·85		
Phosphoric oxychloride,	$POCl_3$	107·5	2·951			Tubes	Schiff
		19·5		3·259	32·00	„	
„ sulphochloride,	$PSCl_3$	125	2·952			„	Schiff
Nitrogen peroxide,	$(NO_2)_x$	19·5		2·42	23·76		
Nitric acid,	HNO_3	18·5		4·275	41·97		
Sulphuric acid,	H_2SO_4	14·5		6·333	62·17		
Amylene,	C_5H_{10}	16·5	5·380	1·753	17·21	Tubes	Mendelejeff
		36·8	4·852	1·541	15·13	„	Schiff
Hexane,	C_6H_{14}	2·1	6·167			„	„
		68·1	4·514	1·386	13·60	„	„

Di-isobutyl, ...	C_8H_{18}	6°·2	6·195			Tubes	Schiff
		107·4	3·909	1·205	11·83	,,	,,
Cetene, ...	$C_{16}H_{32}$	15	7·002	2·763	27·14	,,	Mendelejeff
Benzol, ...	C_6H_6	15		2·760	27·09	,,	Bède
		15		2·998	29·43	,,	Wilhelmy
		6·7	6·9685			,,	Schiff
		79·9	5·245	2·127	20·88	,,	,,
$d_0 = 0·8993$, . . .		0	6·938			,,	Timberg
$d_0 = 0·8985$, . . .		0	6·960	3·12	30·63	,,	,,
		20 (circ.)	5·678	1·982	19·46	Bubbles	Magie
		15	6·817	2·887	28·34	Tubes	Mendelejeff
		55·2			23·47	Drops	Guye and Perrot
		55·2			23·56	Tubes	,,
Toluol, ...	C_7H_8	15	6·654	2·849	27·96	,,	Mendelejeff
		5·8	6·961			,,	Schiff
		109·8	4·746	1·846	18·12	,,	,,
Xylol, ortho, ...	C_8H_{10}	15		2·752	27·02	Tubes	Mendelejeff
		5	7·030			,,	Schiff
		141·1	4·430	1·6745	16·44	,,	,,
,, meta, ...		4	7·0365			,,	,,
		139·2	4·437	1·6795	16·49	,,	,,
,, para, ...		4	6·990			,,	,,
		138·1	4·416	1·6655	16·35	,,	,,
Mesitylene, ...	C_9H_{12}	54·2			23·82	Drops	Guye and Perrot
Cymol, ortho. . . .	$C_{10}H_{14}$	15·7	6·586	2·849	27·96	Tubes	Mendelejeff
		176·2	3·839	1·391	13·65	,,	Schiff
,, para, ...		3·4	7·018			,,	,,
		176·2	3·8535	1·3965	13·71	,,	,,

Turpentine, ...	$C_{10}H_{16}$	0	6·71				Frankenheim
		21·7	6·234	2·765	27·14	Tubes	Quincke
		25·1		3·033	29·77	Bubbles	,,
$d_{20}=0·863$, . .		20	6·434	2·776	27·25	,,	Magie
$d_{20}=0·868$, . .		20	6·180	2·682	26·33	Drops	,,
$d_{21}=0·894$, . .		21	6·100	2·726	26·76	,,	,,
$d_{21}=0·933$, . .		21	5·826	2·718	26·68	,,	,,
Citron oil, $d_0=0·836$, . .	$C_{10}H_{16}$	0	6·88				Frankenheim
$d_0=0·838$, . .		0	7·10				,,
Petroleum, $d_0=0·847$, . .		0	6·95				,,
		18	6·216	2·441	23·96	Drops	Magie
		20 (circ.)	6·758	2·643	25·94	Bubbles	,,
Methyl iodide, . . .	CH_3I	43	2·532			Tubes	Schiff
Acetonitril, ...	CH_3CN	81	6·047			,,	,,
Ethyl chloride, . . .	C_2H_5Cl	0	4·46	1·982	19·46	,,	Bède
,, bromide, . . .	C_2H_5Br	15	3·436	2·438	23·93	,,	Mendelejeff
		14·7	3·55	2·518	24·72	,,	Bède
,, iodide, . . .	C_2H_5I	15	3·014	2·910	28·57	,,	Mendelejeff
		16	2·94	2·838	27·86	,,	Bède
,, nitrate, ...	$C_2H_5NO_3$	87	4·330			,,	Schiff
,, cyanide (propionitril), .	C_2H_5CN	97	5·453			,,	,,
Ethylene chloride,. . .	$C_2H_4Cl_2$	16·2	5·21	3·256	31·96	,,	Bède
		8	5·499			,,	Schiff
		83·3	4·198	2·429	23·84	,,	,,
,, bromide,. . .	$C_2H_4Br_2$	130	2·654			,,	,,
		54·3			47·56	Drops	Guye and Perrot
Propyl ,, ...	C_3H_7Br	0	4·184			Tubes	Schiff
		71	3·170			,,	,,
Isopropyl ,, ...	$(CH_3)_2CHBr$	0	4·002			,,	,,
		61	3·125			,,	,,
Propyl iodide, . . .	C_3H_7I	0	3·645			,,	,,
		103	2·574			,,	,,
Isopropyl ,, ...	$(CH_3)_2CHI$	0	3·4596			,,	,,
		89	2·529			,,	,,
Propylene chloride, . .	$C_3H_6Cl_2$	98	3·881			,,	,,
,, bromide, . .	$C_3H_6Br_2$	142	2·543			,,	,,

				In Mgms. per mm.	In Dynes per cm.	Method.	Authority.
Allyl bromide, . . .	C_3H_5Br	0°	4·2869			Tubes	Schiff
		70	3·251			,,	,,
,, iodide, ...	C_3H_5I	0	3·747			,,	,,
		102	2·625			,,	,,
Isobutyl chloride, . . .	$(CH_3)_2CHCH_2Cl$	68	4·127			,,	,,
,, bromide, . . .	$(CH_3)_2CHCH_2Br$	0	4·650			,,	,,
		91	3·103			,,	,,
,, iodide, . . .	$(CH_3)_2CHCH_2I$	0	3·786			,,	,,
		120	2·553			,,	,,
,, cyanide, . . .	$(CH_3)_2CHCH_2CN$	129	4·900			,,	,,
Capronitril, ...	C_4H_9CN	154	4·647			,,	,,
Amyl chloride, . . .	$C_5H_{11}Cl$	15	5·616	2·455	24·10	,,	Mendelejeff
Isoamyl ,, . . .	$(CH_3)_2CHCH_2CH_2Cl$	99	4·022			,,	Schiff
Amyl bromide, . . .	$C_5H_{11}Br$	15	4·317	2·603	25·55	,,	Mendelejeff
Isoamyl bromide, . . .	$(CH_3)_2CHCH_2CH_2Br$	0	4·650			,,	Schiff
		119	3·060			,,	,,
Amyl iodide, ...	$C_5H_{11}I$	15	3·825	2·885	28·32	,,	Mendelejeff
Isoamyl ,, ...	$(CH_3)_2CHCH_2CH_2I$	0	4·070			,,	Schiff
		148	2·472			,,	,,
Amyl nitrate, . . .	$C_5H_{11}NO_3$	147	3·612			,,	,,
Chlorbenzol, ...	C_6H_5Cl	0	6·540			,,	,,
		132	4·211			,,	,,
Brombenzol, ...	C_6H_5Br	0	5·325			,,	,,
		156	3·219			,,	,,
Iodbenzol, ...	C_6H_5I	0	3·625			,,	,,
		188	2·674			,,	,,
Benzonitril, ...	C_6H_5CN	54·4			33·93	Drops	Guye and Perrot
		54·4			33·98	Tubes	,,

		190	5·000			Tubes	Schiff
Chloroform, ...	$CHCl_3$	12·5	3·80	2·812	27·60	„	Bède
		16·6	3·673	2·733	26·83	„	Quincke
		24·2		3·120	30·63	Bubbles	„
		8	3·874			Tubes	Schiff
		60·6	3·150	2·210	21·69	„	„
$d_{20}=1·405$, . . .		20	3·755	2·638	25·90	Drops	Magie
$d_{20}=1·482$, . . .		20 (circ.)	3·697	2·740	26·90	Bubbles	„
$d_{20}=1·485$, . . .		20	3·668	2·724	26·74	Drops	„
Nitromethane, . . .	CH_3NO_2	102	5·087				Schiff
		0	7·08				„
Chlorpicrin, ...	CCl_3NO_2	112	2	2·828	27·76		„
Trichlorethane, . . .	$C_2H_3Cl_3$	114	3·495				„
Nitroethane, ...	$C_2H_5NO_2$	114·5	4·578			Tubes	„
Nitrobenzol, ...	$C_6H_5NO_2$	54·3		38·19		Drops	Guye and Perrot
		208	5·350			Tubes	Schiff
Methyl alcohol, . . .	CH_3OH	15	6·016	2·426	23·81	„	Mendelejeff
		14	6·00	2·419	23·75	„	Bède
		64·2	5·107	1·909	18·74	„	Schiff
		20 (circ.)	6·056	2·459	24·15	Bubbles	Magie
Ethyl alcohol, . . .	$CH_3.CH_2.OH$	0	6·24				Buys-Ballot
$d_0=0·8208$, . . .		0	6·05				Frankenheim
$d_0=0·9274$, . . .		0	6·41				„
$d_0=0·9667$, . . .		0	7·27				„
		5·5	5·956			Tubes	Mendelejeff
		15	5·944	2·365	23·22	„	„
		14	5·75	2·342	22·99	„	Bède
		18·4		2·325	22·82	„	Wilhelmy
		21·8	5·639	2·237	21·96	„	Quincke
$d_{19·3}=0·8063$, . . .		0	6·061				Sondhauss
$d_{19·3}=0·9237$, . . .		0	6·464				„
		21 (circ.)		2·542	24·96	Tubes	Kundt
		0	6·6128				Scholz
		78	4·782	1·765	17·33	Tubes	Schiff
		20	5·599	2·214	21·74	Drops	Magie

TABLE LXXIX.—*continued*.

Name.	Formula.	$t°$ C.	a^2.	Values of a: In Mgms. per mm.	Values of a: In Dynes per cm.	Method.	Authority.
Ethyl alcohol, ...		0°	6·074	2·585	25·45		Timberg
		0	6·603				,,
		20	5·084	2·016	19·69	Bubbles	Sieg
		20 (circ.)	5·652	2·242	22·01	,,	Magie
Propyl alcohol, . . .	$CH_3CH_2CH_2OH$	5·8	6·223			Tubes	Schiff
		97·1	4·718	1·762	17·30	,,	,,
Isopropyl ,, . . .	$(CH_3)_2CHOH$	5·3	5·780			,,	,,
		81·1	4·592	1·702	16·71	,,	,,
Allyl ,, . . .	C_3H_5OH	4·2	6·429			,,	,,
		96·4	5·006	1·955	19·19	,,	,,
Glycerol, ...	$C_3H_5(OH)_3$		10·765	6·801	66·76		
Amyl alcohol, . . .	$C_5H_{11}OH$	15	6·006	2·445	24·00	Tubes	Mendelejeff
		16	5·96	2·426	23·81	Tubes	Bède
		15		2·427	23·82	,,	Wilhelmy
Isoamyl ,, . . .	$(CH_3)_2CHCH_2OH$	131·4	4·289	1·534	15·06	,,	Schiff
Ethyl ether, ...	$(C_2H_5)_2O$	0	5·208				Artur
		0	5·3536			Tubes	Brunner
		0	5·40			,,	Frankenheim
		14·5	5·37			,,	,,
		0	5·7885				Wolff
		15·8		1·892	18·57	Tubes	Bède
		12	5·37			,,	Duprez
		14·2		1·815	17·82	,,	Wilhelmy
		17·5	5·0309			,,	Rodenbeck
		21 (circ.)		1·957	19·21	,,	Kundt
		0	5·296			,,	Scholz
		0	5·192			,,	Schiff
		34·6	4·521	1·571	15·42	Tubes	Schiff

		20	4·84	1·755	17·23	Bubbles	Sieg
		20 (circ.)	4·977	1·804	17·71	,,	Magie
Methyl amyl ether, . .	$CH_3OC_5H_{11}$	91	4·05			Tubes	Schiff
Ethyl ,, ,, . . .	$C_2H_5OC_5H_{11}$	15		2·338	22·95	,,	Mendelejeff
Formic acid, ...	HCOOH	14	6·3531			,,	Rodenbeck
		0	6·633			,,	Schiff
		100	5·284			,,	,,
		20 (circ.)	7·137	4·097	40·22	Bubbles	Magie
Acetic acid, ...	CH_3COOH	15·6	5·576	2·957	29·03	Tubes	Mendelejeff
		12·5	5·56	2·948	28·94	,,	Bède
		24		2·973	29·18	,,	Wilhelmy
		18	6·1873			,,	Rodenbeck
		0	5·627			,,	Schiff
		117·2	3·872			,,	,,
		20 (circ.)	8·577	4·452	43·70	Bubbles	Magie
Propionic acid, . . .	CH_3CH_2COOH	14	6·0549			Tubes	Rodenbeck
		0	5·832			,,	Schiff
		140·7	3·725			,,	,,
Butyric ,, . . .	$CH_3.CH_2.CH_2.COOH$	16	5·746	2·779	27·28	,,	Mendelejeff
		14	5·8807			,,	Rodenbeck
		0	6·014			,,	Schiff
		162·7	3·545			,,	,,
Isobutyric ,, . . .	$(CH_3)_2CH.COOH$	0	5·784			,,	,,
		153·2	3·428			,,	,,
Valeric ,, . . .	C_4H_9COOH	0	5·925			,,	,,
		174·5	3·283			,,	,,
		15		2·703	26·53	,,	Mendelejeff
		14		2·828	27·76	,,	Wilhelmy
Lactic ,, ...	$CH_3CHOH.COOH$	15		3·936	38·64	,,	Mendelejeff
Salicylic ,, ...	$OH.C_6H_4COOH$			4·769	46·81	,,	,,
Gaultheric ,, ...				4·113	40·38	,,	,,
Methyl formate, . . .	$HCOOCH_3$	32		4·944	48·53	,,	Schiff
,, acetate, . . .	CH_3COOCH_3	16	5·47	2·582	25·35	,,	Bède
		7	5·759			,,	Schiff
		55·3	4·556	2·010	19·73	,,	,,

TABLE LXXIE.—*continued.*

Name.	Formula.	$t°$ C.	a^2.	Values of α In Mgms. per mm.	Values of α In Dynes per cm.	Method.	Authority.
Ethyl formate, . . .	$HCOOC_2H_5$	16·4°	5·6	2·632	25·84	Tubes	Bède
		5·2	5·562			,,	Schiff
		53·6	4·528	1·976	19·40	,,	,,
Methyl propionate, . .	$C_2H_5COOCH_3$	4·4	5·878			,,	,,
		79·5	4·289	1·806	17·73	,,	,,
Ethyl acetate, . . .	$CH_3COOC_2H_5$	10·4	5·684	2·552	25·05	,,	Mendelejeff
		11·7	5·62			,,	Bède
		24·6		2·564	25·16	,,	Wilhelmy
		6·3	5·738			,,	Schiff
		75·5	4·268	1·771	17·38	,,	,,
Propyl formate, . . .	$HCOOC_3H_7$	10	5·850			,,	,,
		82·5	4·486	1·811	17·78	,,	,,
Methyl butyrate, . . .	$C_3H_7COOCH_3$	7·5	5·934			,,	,,
		102·5	4·036	1·625	15·95	,,	,,
Methyl isobutyrate, . .	$i-C_3H_7COOCH_3$	54·8			26·55	Drops	Guye and Perrot
Ethyl propionate, . . .	$C_2H_5COOC_2H_5$	4·5	5·829			Tubes	Schiff
		99	3·980	1·584	15·55	,,	,,
Propyl acetate, . . .	$CH_3COOC_3H_7$	6·1	5·878			,,	,,
		102·5	4·022	1·592	15·63	,,	,,
Ethyl butyrate, . . .	$C_3H_7COOC_2H_5$	14·5	5·727	2·547	25·00	,,	Mendelejeff
		4·5	5·941			,,	Schiff
		118·8	3·776	1·454	14·27	,,	,,
Propyl propionate, . .	$C_2H_5COOC_3H_7$	4·5	6·04			,,	,,
		23·7	3·804	1·461	14·34	,,	,,
Amyl formate, . . .	$HCOOC_5H_{11}$	15		2·611	25·63	,,	Mendelejeff
Propyl butyrate, . . .	$C_3H_7COOC_3H_7$	5·8	6·117			,,	Schiff
		143·5	3·621	1·350	13·25	,,	,,
Amyl acetate, . . .	$CH_3COOC_5H_{11}$	15		2·611	25·63	,,	Mendelejeff

„ butyrate, . . .	$C_3H_7COOC_5H_{11}$	15		2·621	25·73	„	„
„ valerate, . . .	$C_4H_9COOC_5H_{11}$	15		2·600	25·52	„	„
Allyl acetate, . . .	$CH_3COOC_3H_5$	103	4·106			„	Schiff
Methyl benzoate, . . .	$C_6H_5COOCH_3$	15		3·883	38·12	„	Mendelejeff
		0	7·37			„	Schiff
		200	3·982			„	„
„ cresolate, . . .	$CH_3OC_7H_7$	0	7·50			„	„
		175	4·278			„	„
Ethyl benzoate, . . .	$C_6H_5COOC_2H_5$	15		3·674	36·16	„	Mendelejeff
		0	7·23			„	Schiff
		213	3·709			„	„
„ oxalate, . . .	$C_2O_4(C_2H_5)_2$	15		3·327	32·66	„	Mendelejeff
				3·112	30·55	„	Bède
		0	6·37			„	Schiff
		186	3·562			„	„
„ monochloracetate, .	$CH_2Cl.COOC_2H_5$	144	3·529			„	„
„ dichloracetate, . .	$CHCl_2COOC_2H_5$	158	3·143			„	„
„ trichloracetate, . .	$CCl_3COOC_2H_5$	167	2·749			„	„
Methyl thiocyanate, . .	CH_3CNS	0	7·61			„	„
		133	5·132			„	„
Ethyl thiocyanate, . .	C_2H_5CNS	0	7·23			„	„
		143·5	4·792			„	„
„ sulphide, . . .	$(C_2H_5)_2S$	0	6·65			„	„
		91·5	4·644			„	„
Acetoacetic ether, . . .	$CH_3COCH_2COOC_2H_5$	0	6·80			„	„
		180	3·940			„	„
Ethyl silicate, . . .			4·736	2·209	21·68		
Allyl mustard oil, . . .	$CH_2.CH.CH_2.NCS$	0	7·30			Tubes	Schiff
		151	4·793			„	„
Thiocarbanil, ...	C_6H_5NCS	220	4·339			„	„
Thiophen, ...	C_4H_4S	0	6·783			„	„
Acetanhydride, . . .	$(C_2H_3O)_2O$	12·7	6·121	3·303	32·42	„	Mendelejeff
		0	6·55			„	Schiff
		138	4·181			„	„
Acetone, . . .	CH_3COCH_3	5	6·389			„	Mendelejeff
		15	6·133	2·456	24·11	„	„
		14·2		2·581	25·33	„	Wilhelmy

TABLE LXXIE.—*continued.*

Name.	Formula.	$t°$ C.	a^2.	Values of a In Mgms. per mm.	Values of a In Dynes per cm.	Method.	Authority.
Acetone, ...		15°		2·486	24·40	Tubes	Bède
		56·1	5·189	1·947	19·11	"	Schiff
Chloral, ...	CCl_3CHO	0	4·316			"	"
		97	3·021			"	"
Dimethyl acetal, . . .	$CH_3CH(OCH_3)_2$	0	5·68			"	"
		63	4·303			"	"
Valeraldehyde, . . .	C_4H_9CHO	0	6·42			"	"
		93	4·611			"	"
Metacresol, ...	$OH.C_6H_4CH_3$	54·7			33·05	Drops	Guye and Perrot
Benzoic aldehyde, . . .	C_6H_5CHO	15		4·164	40·87	Tubes	Mendelejeff
Cuminol, ...	$(CH_3)_2CH.C_6H_4CHO$	15		3·669	36·02	"	"
		0	7·40			"	Schiff
		237	3·830			"	"
Anisol, ...	$CH_3OC_2H_5$	0	7·68			"	"
		155	4·554			"	"
Phenetol, ...	$C_2H_5OC_6H_5$	0	7·42			"	"
		172	4·120			"	"
		55			27·50	Drops	Guye and Perrot
Dimethyl resorcin, . .	$C_6H_4(OCH_3)_2$	0	7·77			Tubes	Schiff
		215	4·097			"	"
Acetophenone, ...	$C_6H_5COCH_3$	54·4			34·43	Drops	Guye and Perrot
Benzophenone, ...	$C_6H_5COC_6H_5$	54·3			40·08	"	"
Furfurol, ...	$C_5H_4O_2$	0	8·06			Tubes	Schiff
		160	5·200			"	"
Carvol, ...	$C_{10}H_{14}O$	0	7·69			"	"
		228	4·029			"	"
Epichlorhydrin, . . .	C_3H_5OCl	0	6·76			"	"
		116	4·652			"	"
Benzoyl chloride, . . .	C_6H_3COCl	15		4 067	39·92	"	Mendelejeff
		0	6·89			"	Schiff

		195	3·966			"	"
Benzylidene chloride, . .	$C_6H_5CHCl_2$	0	6·43			"	"
		204	3·950			"	"
Phosphoethyl chloride, . .	$POC_2H_5Cl_2$	0	4·75			"	"
		116	3·170			"	"
Diethyl amine, . . .	$NH(C_2H_5)_2$	56	4·986			"	"
Triethyl " . . .	$N(C_2H_5)_3$	89	4·205			"	"
Propyl " . . .	$NH_2C_3H_7$	49	5·696			"	"
Allyl " . . .	$NH_2C_3H_5$	56	5·907			"	"
Isobutyl " . . .	$NH_2(C_4H_9)$	68	5·218			"	"
Amyl " . . .	$NH_2C_5H_4$	95	4·936			"	"
Anilin, ...	C_6H_7N	0	9·68			"	"
		183	5·405			"	"
Chinolin, ...	C_9H_7N	0	8·82			"	"
		235	4·833			"	"
Pyridin, ...	C_5H_5N	0				"	"
		116	5·549			"	"
Piperidin, ...	$C_5H_{11}N$	0	7·60			"	"
		105	5·303			"	"
		55·4			25·23	Drops	Guye and Perrot
Pinacolin, ...	$C_6H_{12}O$	0	6·44			Tubes	Schiff
		106	4·267			"	"
Ethyl aniline, . . .	$C_6H_5NHC_2H_5$	54·4			32·06	"	Guye and Perrot
		54·4			32·46	Drops	"
Dimethyl aniline, . . .	$C_6H_5N(CH_3)_2$	54·3			31·64	"	"
Orthotoluidine, . . .	$CH_3C_6H_4NH_2$	54·4			35·26	"	"
		54·4			34·01	Tubes	"
Dimethyl orthotoluidine, .	$CH_3C_6H_4N(CH_3)_2$	55			27·57	"	"
		55			27·69	Drops	"
Urethane, ...	$CN.O.OC_2H_5$	53·8			31·92	"	"
		53·8			31·33	Tubes	"
Olive oil, ...		0	7·461				Brunner
		13	7·40			Tubes	Frankenheim
		22	7·159	3·271	32·11	"	Quincke
		25·8		3·760	36·91	Bubbles	"
				3·27	32·10	Tubes	Marangour, etc.
		18	7·11	3·235	31·75	Drops	Magie
		20	7·68	3·52	34·55	Bubbles	Sieg

Influence of Temperature on Surface Tension, etc.

or all liquids there is a *diminution* of surface tension with an *increase* in the erature, but the law connecting the two cannot be said to be thoroughly understood. ollowing empirical equation is frequently employed to denote the relation between e tension and temperature—

$$\alpha_t = \alpha_0(1 - \mu t + \xi t^2).$$

onstant ξ has frequently the value 0, so that—

$$\alpha_t = \alpha_0(1 - \mu t).$$

or water and other liquids various values for the constants in these equations are in Table LXXIF$_1$.

nipp gives the following proportional numbers for the surface tension of water up to ts critical temperature :—

	Numbers Proportional to Surface Tension.	t°.	Numbers Proportional to Surface Tension.	t°.	Numbers Proportional to Surface Tension.	t°.	Numbers Proportional to Surface Tension.
C.	44·2	100° C.	31·6	200° C.	19·3	300°C.	7·2
	43·2	110	30·4	210	18·2	310	6·2
	41·7	120	29·1	220	17·	320	5·5
	40·5	130	27·9	230	15·7	330	4·7
	39·1	140	26·7	240	14·5	335	4·4
	37·8	150	25·5	250	13·2	340	4·1
	36·6	160	24·1	260	12·1	345	3·9
	35·4	170	23·	270	10·9	350	3·4
	34·1	180	21·9	280	9·7	352·5	3·
	32·9	190	20·6	290	8·5	355	2·1
						357·5	1·

us if the surface tension be 77·74 at 0° we get—

$$\alpha_{100} = \frac{77·74}{44·2} \times 31·6 = 55·58 \text{ very nearly,}$$

does not agree at all with the value calculated from Knipp's formula—

$$\alpha_{100} = \alpha_0\{1 - (100 \times 0·00191)\} = 62·89,$$

ith the value obtained by the compiler

59·28.

t the critical temperature, as there can be no separating surface between a liquid and pour, it was supposed that the surface tension would become *nil*, so that

$$\alpha\vartheta = \alpha_0(1 - \mu\vartheta) = 0$$
$$\text{and} \qquad \mu\vartheta = 1.$$

None of the formulæ of this form given for water will give anything near the experimental value for ϑ; the lowest value for μ gives

$$\vartheta = 556^\circ \text{ C.},$$

and the highest—

$$\vartheta = 435^\circ \text{ C.}$$

Of the formulæ of the form—

$$a_\vartheta = a_0(1 - \mu\vartheta + \xi\vartheta^2)$$

Wolff and Weinberg's will give no value for ϑ, but the one adopted by the compiler from surface tension results merely, and without any reference at first to the critical temperature, gives—

$$\vartheta = 343^\circ \text{ C.},$$

which is most probably within some twenty degrees of the true value: a pretty close approximation starting with a somewhat erroneous hypothesis.

TABLE LXXIF.—**Relations between Surface Tension, etc., and Temperature.** (From R. Schiff's Determinations.)

$t°$ = boiling temperature under pressure B.
B = pressure under which the boiling temperature was observed.
σ = density of liquid at its boiling point under pressure B.
M/σ = molecular weight divided by the density = molecular volume at the boiling point.
$\tau°$ = temperature between which and $t°$ the capillarity constants were determined.
a^2_0 = specific cohesion at 0° (calculated).

a^2_t = specific cohesion at boiling point as determined.
β = coefficient in the equation $a^2_t = a^2_0 - \beta t$.
β_1 = coefficient in the equation $a^2_t = a^2_0(1 - \beta_1 t)$.
H = $a^2_t\sigma/2$.
N = 1000H/M, a number that is proportional to the number of elevated molecules per unit length.
T = critical temperature at which Schiff takes $a^2 = 0$.

* All results marked with an asterisk are from Schiff's later researches.

Substance.	Formula.	$t°$.	B.	σ.	M/σ.	$\tau°$.	a^2_0.	a^2_t.	β.	β_1.	H.	N.	T°.
1. Hexane,	C_6H_{14}	68°·1	751·3	0·6142	139·72	2°·1	6·220	4·514	·0250	0·004019	1·386	16·1	
2. Di-isobutyl,	C_8H_{18}	107 ·4	751·2	6166	184·49	6 ·2	6·335	3·909	226	3567	1·205	10·5	
3. Di-isoamyl,	$C_{10}H_{22}$	159 ·1	751·1	6126	231·31	2 ·6	6·653	3·579	193	2901	1·096	7·7	
4. Amylene,	C_5H_{10}	36 ·8	752·7	6353	109·95	4 ·3	5·738	4·852	273	4740	1·541	22	
5. Caprylene,	C_8H_{16}	124 ·6	769·6	6306	177·22	2	6·744	4·080	214	3175	1·286	11·5	
6. Di-allyl,	C_6H_{10}	58 ·4	751·8	6503	125·82	4 ·1	6·034	4·627	241	3994	1·504	18·3	
7. Benzol,	C_6H_6	79 ·9	764·1	8111	95·94	6 ·7	7·126	5·245	235	3295	2·127	27·3	
8. Toluol,	C_7H_8	109 ·8	759·4	7780	117·97	5 ·8	7·084	4·746	213	3007	1·846	20·1	
9. Xylol, 1 : 2,	C_8H_{10}	141 ·1	756·2	7559	139·91	5 ·9	7·153	4·437	192	2684	1·677	16·0	
10. ,, 1 : 3,	C_8H_{10}	139 ·2	759·7	7571	139·67	4	7·116	4·437	192	2698	1·679	15·9	
11. ,, 1 : 4,	C_8H_{10}	138 ·1	761·2	7543	144·20	4	7·067	4·430	191	2708	1·670	15·8	
12. Ethyl-benzol,	C_8H_{10}	135 ·9	738·1	7611	138·95	4 ·5	7·191	4·495	198	2753	1·710	16·2	
13. Normal propyl-benzol,	C_9H_{12}	158 ·7	750	7399	161·82	4 ·5	7·223	4·219	190	2630	1·561	13·0	
14. Ethyl-toluol,	C_9H_{12}	161 ·8	761·3	7393	161·95	4 ·5	7·171	4·184	185	2566	1·546	12·9	
15. Mesitylene,	C_9H_{12}	165	762	7372	162·40	4 ·5	7·115	4·085	184	2588	1·506	12·6	
16. Cymol,	$C_{10}H_{14}$	176 ·2	769·3	7248	184·46	3 ·4	7·081	3·839	184	2599	1·391	10·4	
17. Citron-terpene,	$C_{10}H_{16}$	168 ·2	763·2	7283	186·3	86	6·99	3·772	191	2732	*1·374	10·1	
18. Methyl alcohol,	CH_4O	64 ·2	755·8	7475	42·71	7 ·3	6·028	5·107	159	2595	1·909	59·8	366°
19. Ethyl alcohol,	C_2H_6O	78	755·7	7381	62·81	5 ·5	6·045	4·782	162	2680	1·765	38·4	
20. Propyl alcohol,	C_3H_8O	97 ·1	752·2	7365	81·28	5 ·8	6·319	4·718	165	2611	1·762	29	
21. Isopropyl alcohol,	C_3H_8O	81 ·3	753·4	7329	81·69	6	5·875	4·592	158	2689	1·702	28·2	
22. Isobutyl alcohol,	$C_4H_{10}O$	106 ·4	753·6	7265	101·63	6 ·3	6·165	4·416	164	2660	1·604	21·7	
23. Isoamyl alcohol,	$C_5H_{12}O$	131 ·4	767·9	7154	122·74	4 ·6	6·288	4·289	141	2242	1·534	17·4	
24. Dimethyl-ethyl carbinol,	$C_5H_{12}O$	120	763·2	7241	121·26	3 ·9	6·005	4·283	143	2381	1·550	17·6	
25. Allyl alcohol,	C_3H_6O	96 ·4	753·4	7809	74·10	4 ·2	6·493	5·006	154	2372	1·955	33·8	
26. Formic acid,	CH_2O_2	100 ·3	763·5	1·1170	41·1	88 ·7	6·633	5·284	1345	2024	*2·950	64·3	492
27. Acetic acid,	$C_2H_4O_2$	117 ·2	761·5		63·2	92 ·5	5·627	3·872	150	2664	*1·831	30·6	375
28. Propionic acid,	$C_3H_6O_2$	140 ·7	758·5		85·4	91 ·4	5·832	3·725	150	2573	*1·609	21·7	388
29. Butyric acid,	$C_4H_8O_2$	162 ·7	762·4		107·8	111 ·2	6·014	3·545	152	2529	*1·444	16·4	395
30. Isobutyric acid,	$C_4H_8O_2$	153 ·2	750·5		108·6	94 ·5	5·784	3·428	154	2664	*1·394	15·8	375

31. Valeric acid, . . .	$C_5H_{10}O_2$	174 ·5	750·8		130·2	115 ·3	5·925	3·283	151	2551	*1·283	12·6	392
32. Acetic anhydride, . .	$C_4H_6O_3$	138	762·2		109·7	94 ·5	6·554	4·181	172	2626	*1·939	19·1	380
33. Methyl formate, . .	$C_2H_4O_2$	32 ·4	761·4		62·6			4·944			*2·364	39·6	
34. Ethyl formate, . . .	$C_3H_6O_2$	53 ·6	757·3	0·8730	84·57	5 ·2	5·673	4·528	214	3684	1·976	26·8	
35. Propyl formate, . . .	$C_4H_8O_2$	82 ·5	763	8075	108·73	10	6·038	4·485	188	3114	1·811	20·6	
36. Isobutyl formate, . .	$C_5H_{10}O_2$	98 ·5	747·5	7784	130·74	5 ·2	5·967	4·149	185	3100	1·615	15·8	
37. Isoamyl formate, . .	$C_6H_{12}O_2$	123 ·5	747·7	7554	153·21	5 ·2	6·128	4·064	167	2725	1·540	13·3	
38. Methyl acetate, . . .	$C_3H_6O_2$	55 ·3	759·2	8825	83·66	7	5·933	4·556	249	4197	2·010	27·2	
39. Ethyl acetate, . . .	$C_4H_8O_2$	75 ·5	755·2	7300	105·70	6 ·3	5·871	4·268	211	3594	1·771	20·2	
40. Propyl acetate, . . .	$C_5H_{10}O_2$	102 ·5	760·2	7916	128·56	6 ·1	5·995	4·022	193	3219	1·592	15·6	
41. Isobutyl acetate, . .	$C_6H_{12}O_2$	112 ·8	760·3	7589	150·51	6	5·951	3·923	180	3025	1·489	12·8	
42. Isoamyl acetate, . .	$C_7H_{14}O_2$	138 ·9	758·2	7429	174·59	4 ·2	6·126	3·720	171	2791	1·381	10·6	
43. Allyl acetate, . . .	$C_5H_8O_2$	102 ·8	752		121·4			4·106			*1·215	16·9	
44. Methyl propionate, . .	$C_4H_8O_2$	79 ·5	757·1	8422	104·24	4 ·4	5·971	4·289	212	3550	1·806	20·6	
45. Ethyl propionate, . .	$C_5H_{10}O_2$	99	753·3	7960	127·83	4 ·5	5·917	3·980	196	3318	1·584	15·6	
46. Propyl propionate, . .	$C_6H_{12}O_2$	121 ·7	753·9	7680	150·70	4 ·5	6·126	3·804	191	3118	1·461	12·6	
47. Isobutyl propionate, . .	$C_7H_{14}O_2$	137°–137°·3	763	7474	173·54	7 ·2	6·037	3·544	182	3001	1·324	10·2	
48. Isoamyl propionate, . .	$C_8H_{16}O_2$	160°·5	752·3	7295	196·95	4 ·5	6·230	3·459	173	2777	1·262	8·8	
49. Methyl butyrate, . .	$C_5H_{10}O_2$	102 ·5	763·5	8054	126·35	7 ·5	6·084	4·036	200	3287	1·625	15·9	
50. Ethyl butyrate, . . .	$C_6H_{12}O_2$	118 ·8	750·3	7703	150·25	4 ·5	6·026	3·776	189	3136	1·454	12·6	
51. Propyl butyrate. . .	$C_7H_{14}O_2$	143 ·5	762·7	7461	173·85	5 ·8	6·222	3·621	181	2909	1·350	10·4	
52. Isobutyl butyrate, . .	$C_8H_{16}O_2$	157°–157°·5	762·6	7269	197·66	5 ·8	6·149	3·361	177	2878	1·221	8·5	
53. Methyl isobutyrate, . .	$C_5H_{10}O_2$	92°·4	760·7	8049	126·43	5 ·2	5·754	3·965	194	3372	1·595	15·7	
54. Ethyl isobutyrate, . .	$C_6H_{12}O_2$	109 ·9	752·5	7681	150·68	4 ·5	5·803	3·692	192	3309	1·418	12·3	
55. Propyl isobutyrate, . .	$C_7H_{14}O_2$	134 ·8	760·3	7446	174·20	5 ·7	6·010	3·544	183	3048	1·319	10·2	
56. Isobutyl isobutyrate, . .	$C_8H_{16}O_2$	148°·5–149°·5	759·2	7249	198·20	7 ·9	5·967	3·368	174	2916	1·220	8·5	
57. Methyl valerate, . .	$C_6H_{12}O_2$	115°–116°	755·1	7803	148·32	14 ·2	5·954	3·858	181	3039	1·503	12·9	
58. Ethyl valerate, . . .	$C_7H_{14}O_2$	133 –134	758·4	7498	172·99	14 ·5	5·998	3·600	180	3001	1·349	10·8	
59. Propyl valerate, . .	$C_8H_{16}O_2$	155°		7300	196·82	15	6·114	3·459	171	2797	1·262	8·8	
60. Ethyl oxalate, . . .	$C_6H_{10}O_4$	186	758·3		166·1	93 ·5	6·37	3·562	151	2370	*1·562	10·7	422°
61. Methyl benzoate, . .	$C_8H_8O_2$	200	754·7		151·8	93 ·5	7·37	3·982	1694	2299	*1·780	13·1	435
62. Ethyl benzoate, . . .	$C_9H_{10}O_2$	213	758·5		174·8	110 ·5	7·23	3·709	1655	2290	*1·588	10·6	436
63. Acetone, ...	C_3H_6O	56 ·1	754·2	7507	77·08	5	6·506	5·189	235	3612	1·947	33·6	
64. Paraldehyde, . . .	$C_6H_{12}O_3$	124 ·1	751·4	8737	150·74	5	5·720	3·530	1765	3085	1·542	11·7	
65. Dimethyl acetal, . .	$C_4H_{10}O_2$	63	754·6	8013	110·81	4	5·557	4·092	2325	4184	1·639	18·4	
66. ,, ,, *	,,	62 ·8	761·2		110·8	60	5·68	4·303	217	3821	*1·744	19·4	261
67. Diethyl acetal, . . .	$C_6H_{14}O_2$	103 ·2	752·8	7363	159·90	4 ·5	5·700	3·656	198	3474	1·346	11·4	
68. Ether, ...	$C_4H_{10}O$	34 ·6	762	6950	106·24	5 ·8	5·324	4·521	232	4357	1·571	21·3	
69. Methylamyl ether, . .	$C_6H_{14}O$	91	765·4	6871	148·1	78 ·3	6·04	4·085	2145	3551	*1·404	13·8	281
70. Acetoacetic ether, . .	$C_6H_{10}O_3$	180	754·5	8458	153·34	91 ·4	6·80	3·940	159	2339	*1·666	12·8	428
71. Anisol, ...	C_7H_8O	155	757·4	8605	125·21	79 ·5	7·68	4·554	202	2630	*1·959	18·0	382
72. Phenetol, ...	$C_8H_{10}O$	171 ·5	763		148·5	77 ·5	7·42	4·120	1925	2615	*1·687	13·8	385
73. Methyl paracresolate, .	$C_8H_{10}O$	175 ·5	762·3	8236	147·79	92 ·5	7·50	4·278	1838	2451	*1·762	14·5	408
74. Dimethyl resorcin, . .	$C_8H_{10}O_2$	214	759·4	8752	157·13	87 ·0	7·77	4·097	1709	2199	*1·795	13·0	454
75. Furfurol, ...	$C_5H_4O_2$	160	753·4		95·52	115 ·5	8·06	5·200	179	2221	*2·606	27·2	450

TABLE LXXIF.—*continued.*

Substance.	Formula.	$t°$.	B.	σ.	M/σ.	$t°$.	α^2_0.	α^2_t.	β.	β_1.	H.	N.	T.
76. Valeraldehyde,	$C_5H_{10}O$	93°	762·1		119·0	78°·7	6·42	4·611	·0195	0·003037	*1·698	19·3	329°
77. Cuminol,	$C_{10}H_{12}O$	237	758·3		187·3	125 ·5	7·40	3·830	1505	2034	*1·510	10·2	491
78. Carvol,	$C_{10}H_{14}O$	227 ·5	763·2		190·3	137 ·5	7·69	4·029	1611	2094	*1·584	10·6	477
79. Pinacoline,	$C_6H_{12}O$	105	758·7	0·7217	138·3	79 ·0	6·44	4·267	206	3199	*1·539	15·4	312
80. Chloroform,	$CHCl_3$	60 ·6	753·4	1·4081	84·56	8	3·984	3·150	1376	3454	2·210	18·6	
81. Carbon tetrachloride,	CCl_4	75 ·2	751·4	1·4802	103·66	7 ·4	3·692	2·756	124	3358	2·040	13·3	
82. Ethylene chloride,	$C_2H_4Cl_2$	83 ·3	753·4	1·1576	85·24	8	5·637	4·198	1728	3065	2·429	24·6	
83. Ethylidene chloride,	$C_2H_4Cl_2$	57	757·1	1·1141	88·56			3·684			2·052	20·8	
84. Propyl chloride,	C_3H_7Cl	47	765·2	0·8561	91·43	5 ·6	5·330	4·359	2345	4400	1·866	23·8	
85. Isobutyl chloride,	C_4H_9Cl	68	761	8073	114·3			4·127			*1·666	18·06	
86. Isoamyl chloride,	$C_5H_{11}Cl$	99 ·5	758·4	7903	134·40			4·022			*1·589	14·9	
87. Propylene chloride,	$C_3H_6Cl_2$	97 ·5	760·3	1·0470	107·6			3·881			*2·031	18·03	
88. Chlorbenzol,	C_6H_5Cl	113 ·5	763·5		114·3	107 ·5	6·540	4·211	1765	2691	*2·067	18·4	370
89. Chlortoluol,	C_7H_7Cl	159 ·5	763·5		134·9	81	6·65	3·992	167	2601	*1·867	14·8	398
90. Benzyl chloride,	C_7H_7Cl	178	763·5	0·9453	135·5	80	7·28	4·200	173	2363	*1·985	15·7	421
91. Perchlorethylene,	C_2Cl_4	120 ·5	756·5		114·2			2·855			*2·068	13·4	
92. Trichlorethane,	$C_2H_3Cl_3$	114	759·8		102·8			3·495			*2·262	16·8	
93. Epichlorhydrin,	C_3H_5OCl	116 ·5	763·6		87·1	79 ·0	6·76	4·652	181	2680	*2·463	26·7	
94. Chloral,	C_2OHCl_3	96 ·5	754·6		106·4	78 ·5	4·316	3·021	134	3102	*2·087	14·1	322
95. Ethyl monochloracetate,	$C_4H_7ClO_2$	144 ·3	753·7		123·1			3·529			*1·751	14·4	
96. Ethyl dichloracetate,	$C_4H_6Cl_2O_2$	157 ·6	754·9		143·4			3·143			*1·715	10·9	
97. Ethyl trichloracetate,	$C_4H_5Cl_3O_2$	166 ·8	753·7		163·9			2·749			*1·600	8·38	
98. Benzoyl chloride,	C_7H_5OCl	194 ·5	754·6		134·7	110 ·5	6·89	3·966	150	2177	*2·063	14·7	459
99. Benzylidene chloride,	$C_7H_6Cl_2$	203 ·5	756·2	1·0407	154·25	93 ·0	6·43	3·950	122	1897	*2·055	12·8	527
100. Bromine,	Br_2	60	762·3		53·45	56	2·924	2·393	0888	3048	*3·571	22·3	329
101. Ethyl bromide,	C_2H_5Br	38 ·4	762·4	1·4134	77·07	38 ·5	3·677	3·140	1381	3750	*2·219	20·4	265
102. Propyl bromide,	C_3H_7Br	71 ·0	762·3		97·0	68 ·5	4·184	3·170	1428	3421	*2·004	16·3	293
103. Isopropyl bromide,	C_3H_7Br	60 ·5	763·8		99 0	52 ·5	4·002	3·125	145	3625	*1·936	15·8	275
104. Allyl bromide,	C_3H_5Br	70	755·5		90·5	55 ·0	4·2869	3·251	148	3450	*2·167	18·0	289
105. Isobutyl bromide,	C_4H_9Br	90 ·5	758·4	1·1456	118·4	81 ·5	4·386	3·103	141	3212	*1·777	13·1	311
106. Isoamyl bromide,	$C_5H_{11}Br$	118 ·5	756·3	1·0881	138·6	87 ·5	4·65	3·060	134	2882	*1·665	11·0	347
107. Brombenzol,	C_6H_5Br	156	759·7	1·3080	119·9	102 ·5	5·325	3·219	135	2538	*2·105	13·4	394
108. Orthobromtoluol,	C_7H_7Br	182 ·5	761·8	1·2031	141·9	112 ·0	5·49	3·133	129	2350	*1·866	11·0	425
109. Ethylene bromide,	$C_2H_4Br_2$	130 ·3	759·5	1·9246	97·6	110 ·0	3·90	2·654	0957	2462	*2·554	13·6	407
110. Propylene bromide,	$C_3H_6Br_2$	141 ·5	759·4		118·4	71 ·7	3·89	2·543	095	2442	*2·163	10·7	409
111. Methyl iodide,	CH_3I	43 ·5	756·5		68·3			2·532			*2·623	18·5	
112. Ethyl iodide,	C_2H_5I	72 ·2	758·3	1·8111	86·1	68 ·5	3·2805	2·539	103	3140	*2·299	14·7	316
113. Propyl iodide,	C_3H_7I	102 ·5	757·4		107·1	85 ·3	3·645	2·574	1045	2857	*2·035	12	348
114. Isopropyl iodide,	C_3H_7I	89	755·6		108·3	77 ·0	3·4596	2·529	1045	3006	*1·978	11·7	331

115. Allyl odide, . . .	C_3H_5I	102	758·5		101·0	66 ·5	3·747	2·625	110	2933	*2·176	13·0	340
116. Isobutyl iodide, . .	C_4H_9I	114 ·5	760·7	1·4335	128·3	74 ·5	3·786	2·553	1032	2718	*1·830	9·9	366
117. Isoamyl iodide, . . .	$C_5H_{11}I$	148	755·3	1·3098	151·1	135	4·07	2·472	108	2653	*1·619	8·2	377
118. Iodobenzol, . . .	C_6H_5I	187 ·5	754·5	1·5612	130·6	158 ·5		2·674			*2·087	10·1	429
119. Propyl amine, . . .	C_3H_9N	49 ·5	755·5	0·6883	85·6			5·696			*1·960	33·3	
120. Allyl amine, . . .	C_3H_7N	56	756·2	7261	78·4			5·907			*2·144	37·7	
121. Isobutyl amine, . .	$C_4H_{11}N$	67 ·7	755·7	6865	106·2			5·218			*1·791	24·6	
122. Amyl amine, . . .	$C_5H_{13}N$	94 ·8	754·2	6848	126·8			4·936			*1·690	19·4	
123. Diethyl amine, . . .	$C_4H_{11}N$	56	777·8	6685	109·0			4·986			*1·667	22·9	
124. Triethyl amine, . . .	$C_6H_{15}N$	89	758·3	6621	153·8			4·205			*1·392	13·7	
125. Aniline, ...	C_6H_7N	183 ·1	758·2	8751	106·7	115 ·0	9·6835	5·405	2338	2418	*2·365	25·5	414
126. Pyridine, ...	C_5H_5N	116	759·5	8825	89·36			5·549			*2·448	31·1	
127. Piperidine, . . .	$C_5H_{11}N$	105	755·7	7800	108·3	82 ·5	7·60	5·303	220	2895	*2·068	24·4	
128. Quinoline, ...	C_9H_7N	234	758·6	9211	139·7	134 ·5	8·8248	4·833	1702	1929	*2·226	17·2	518
129. Nitromethane, . . .	CH_3NO_2	101 ·5	764·7	1·0236	59·5	86 ·4	7·08	5·087	196	2768	*2·603	42·5	361
130. Nitroethane, . . .	$C_2H_5NO_2$	114 ·5	760·7	0·9329	80·25			4·578			*2·134	28·5	
131. Nitrobenzol, . . .	$C_6H_5NO_2$	208	753·5		125·7	128		5·350			*2·612	17·3	419
132. Chlorpicrin, . . .	CCl_3NO_2	112	763·5		110·5	93 ·5	4·27	2·828	128	3000	*2·099	12·7	333
133. Ethyl nitrate, . . .	$C_2H_5NO_3$	87	758·4		91·97	65 ·5	5·73	4·330	161	2810	*2·138	23·5	355
134. Isoamyl nitrate, . .	$C_5H_{11}NO_3$	147	757·8	0·8698	152·59	80 ·7	5·93	3·612	158	2665	*1·571	11·8	376
135. Acetonitril, . . .	C_2H_3N	81 ·2	757·3	7155	57·23			6·047			*2·163	52·8	
136. Propionitril, . . .	C_3H_5N	97	757·1	7015	78·28			5·453			*1·913	34·8	
137. Isobutylnitril, . . .	C_5H_9N	129 ·3	764·3	6921	119·7	82 ·5	7·13	4·900	173	2426	*1·696	20·4	412
138. Capronitril, . . .	$C_6H_{11}N$	154	762·1	6861	141·1	113 ·5	7·08	4·647	158	2232	*1·594	16·4	448
139. Benzonitril, . . .	C_7H_5N	190	759·4		121·6	126 ·5	8·34	5·000	176	2110	*2·114	20·6	474
140. Carbon disulphide, . .	CS_2	46 5	766·5	1·2233	62·06			4·747	211		*2·904	38·3	271·5
141. Allyl-mustard oil, . .	C_4H_5NS	151 ·3	764·2	0·8140	113·1	117 ·5	7·30	4·793	166	2274	*1·951	21·1	439
142. Phenyl-mustard oil, . .	C_7H_5NS	219 ·8	748·8	0·9398	143·4	120		4·339			*2·039	15·1	491
143. Methyl thiocyanate, . .	C_2H_3NS	133 ·9	760·5		78·9	73 ·5	7·61	5·132	186	2444	*2·372	32·5	408
144. Ethyl thiocyanate, . .	C_3H_5NS	143 ·5	758·4		100·07	93 ·5	7·23	4·792	170	2351	*2·081	24·0	425
145. Ethyl sulphide, . . .	$C_4H_{10}S$	91 ·5	757·7		121·82	84 ·5	6·65	4·644	219	3293	*1·713	19·0	303
146. Phosphorus trichloride, .	PCl_3	75 ·4	757·4		93·34	70	4·05	3·017	137	3383	2·215	16·1	295
147. Phosphorus oxychloride, .	$POCl_3$	107 ·5	758·2		101·37	85	4·13	2·951	110	2663	*2·227	14·5	375
148. Ethyl-phosphor-oxychloride,	$POC_2H_5Cl_2$	116 ·5	758·6		128·60	72 ·5	4·75	3·170	136	2863	*1·807	12·4	350
149. Phosphorus thiochloride, .	$PSCl_3$	125	754·6		116·1	72	4·45	2·952	120	2700	2·149	12·7	371

TABLE LXXIF$_1$.—**Relations between Surface Tension, etc., and Temperature.** (Various.)

$a^2_t = a^2_0(1 - \nu t + \sigma t^2_2)$. $\quad$ $^*a^2_t = a^2_0(1 - \nu t)^3$.
$\alpha_t = \alpha_0\,(1 - \mu t + \xi t^2)$.

Substance.	Specific Cohesion.			Surface Tension.			Range of Temperature.	Authority.
	a^2_0	ν	σ	α_0	μ	ξ		
Acetic acid (1·052),	8·51	0·0011*		4·476				Frankenheim
Acetic ether (0·905),	6·10	34*		2·760				,,
Acetone,	6·75	33*						Braun
Alcohol (d_0=0·8208),	6·05	1924		2·483				Frankenheim
,, (d_0=0·9274),	6·41	1877		2·972				,,
,, (d_0=0·9667),	7·27	1862		7·028				,,
,, (absolute),	6·24	1362					20°–69° C.	Buys-Ballot
,, ($d_{19·3}$=0·8063),	6·061	2377	$-0·0_5 3465$	2·444				Sondhauss
,, ($d_{19·3}$=0·9237),	6·464	1898		2·985				,,
,, (absolute),	6·6128	1238						Scholz
,, ,,	6·074	2784		2·585	0·003419		5°·4–72°·2	Timberg
,,	6·603	2303					11·95–59·2	,,
,,					339			Lenard
Benzol (d_0=0·8993),	6·938	3298		3·120			4·1–60·5	Timberg
,, (d_0=0·8985),	6·960	3305		3·12	4236		5·4–70·1	,,
Carbon disulphide (1·290),	5·100	20*		3·29				Frankenheim
Ether,	5·3536	525*					0°– 35°	Brunner
,, (0·757),	5·40	47*		2·044				Frankenheim
,,	5·7885	4595					12–100	Wolff
,,	5·296	4753						Scholz
,,	5·192	4510		1·971	5944		2°·6–25°·7	Timberg
Formic acid (1·105),	10·2	12*		5·636				Frankenheim
,, (1·044),	10·21	13*		5·330				,,
Iodobenzol,	3·625 (a^2_{100})	31 ($t-100$)						Schiff
Methyl acetate,	6·01	36*						Braun
Mercury,	4·050	143					13·6–96·4	Frankenheim
,,	3·978	133					107·9–176·7	,,
,,					13			Jäger
,,	6·769 (at m.p.)	0185τ		46·29 (at m.p.)	0351τ	($\tau=t+39$)	−39° and upwards	Siedentopf
,,	6·720	01863		45·656	03559		0 ,,	Siedentopf, calculated by J.C.-E.
Nitrobenzol,	7·256 (at 40°)	2384 ($t-40$)						Schiff
Phenylthiocarbimid,	7·059 (at 50°)	2266 ($t-50$)						,,
Silicon tetrachloride,	3·0097	473						Mendelejeff

Sulphur (1·930),	4·61 (at 100°)	44 ($t-100$)*						Frankenheim
Sulphuric acid (1·840),	8·40	25*		7·728				,,
Thiophen,	6·783	3103					17°·6–84°	Schiff
Water,	15·373	1911		7·687			0 ·4–89 ·6	Sondhauss
,,	15·999	3222		7·9995				Buys-Ballot
,,	15·50	3871		7·75			10°–40°	,,
,,	15·80	3886		7·90			17 –94	,,
,,	15·3321	1868		7·666			0 –82	Brunner
,,	15·336	1794	$-0{\cdot}0_5 2282$	7·668				Frankenheim
,,	15·42	1258		7·71			$-2°{\cdot}5$–100°	Frankenheim and Sondhauss
,,	16·24	2555		8·12			0°–100°	Simon
,,	15·515	2011	$0{\cdot}0_6 831$	7·757			0 – 25	Wolff
,,	15·768	1817		7·884			0 –100	,,
,,	15·762			7·881	2208			Quincke
,,	15·387	3636	$-0{\cdot}0_5 357$	7·693	362	$0{\cdot}0_4 15$	0 – 40	Volkmann
,,	15·81	20*		7·905				Braun
,,	16·347	1951		8·173			4°·75–80°·2	Timberg
,,	16·413	2475		8·206			9 – 63 ·3	,,
,,	15·233	18	$-0{\cdot}0_6 853$	7·617	1785	$-0{\cdot}0_5 4595$		Eötvös
,,	16·4	21880	$0{\cdot}0_5 37519$	8·17	22051			Weinberg
,,	16·3	19750		8·16	20532	$-0{\cdot}0_5 28432$		,,
,,				76·09 dyne/cm.	2026		0°–27°	Sentis
,,					23			Jager
,,					21			Cantor
,,					2014		Below 0°	Humphreys and Mohler
,,					20			Dorsey
,,					191		0°–100°	Knipp
,,					1866			Lenard
,,				7·9225	2153	$-0{\cdot}0_5 221$	0 –100	J.C.-E.*
Citron oil (0·838),	7·10	23*		2·925				Frankenheim
,, (0·836),	6·88	24*		2·876				,,
Olive oil,	7·461	14*					0 –150	Brunner
Petroleum (0·847),	6·95	23*		2·943				Frankenheim
Turpentine (0·890),	6·71	24*		2·986				,,
Solution of $CaCl_2$ (1·4049),	13·71	1301		9·626	1716		6°·73–65°·47	Timberg
,, ,, (1·2916),		0959			1338			,,
,, $SrCl_2$ (1·3384),	13·23	2572		8·856	2923		6·2–70	,,
,, ,, (1·3036),		1513			1895			,,
,, $ZnCl_2$ (1·363),	10·06	22*						Frankenheim
,, K_2CO_3 (1·4280),	14·16	1715		10·11	2059			Timberg
,, ,, (1·3521).		1528			1881			,,
,, Na_2SO_4 (1·160),	9·472	2893		5·494				Buys-Ballot
,, ,, (1·065),	12·86	4914		6·848				,,
,, KHO (1·274),	7·70	25*		4·905				Frankenheim
,, $CuSO_4$ (1·212),	10·15	2050		6·151				Buys-Ballot

Capillarity Constants of Solutions.

Buliginsky gave the following empirical formula for the surface tension of aqueous solutions :—

$$\alpha_s = \alpha_w(p + kq),$$

where—

α_s = surface tension of solution.
α_w = „ „ „ pure water.
p = weight of water in one gramme of the solution.
q = „ „ substance „ „ „
k = a constant depending on the nature of the substance in solution.

For KNO_3 at 15° C. he found

$$k = 1{\cdot}1628 \text{ nearly},$$

and for NH_4Cl at about 16° C.,

$$k = 1{\cdot}3895.$$

Quincke gives for aqueous solutions :—

$$\alpha_s = \alpha_w + ky\,;\ i.e\ \alpha_s = 7{\cdot}35 + ky,$$

where y = number of "salt-equivalents" (he really employs double the chemical equivalents) to every 100 molecules of water,
k = a constant as before.

For chlorides he finds, employing capillary tubes,

$$k = 0{\cdot}1783\,;$$

but by the air-bubble method he gets

$$\alpha_s = 8{\cdot}30 + 0{\cdot}1870\ y.$$

These equations give moderate approximations for solutions of chlorides and also for solutions of magnesium sulphate, potassium carbonate and sodium carbonate, but they break down completely for those of potassium sulphate, sodium sulphate, zinc sulphate, copper sulphate and sugar.

Dorsey gives an equation of the form,—

$$\alpha_s = \alpha_w + kc,$$

where c = gramme equivalents per litre of the solution. The values of k for a few substances, as calculated from the work of various investigators, may be thus tabulated :—

k for	Volkmann.	Quincke.	Sentis.	Rother.	Dorsey.
$NaCl$, . .	1·59	1·57	1·57	1·38	1·53
KCl, . . .	1·41	1·57	1·41	1·47	1·71
$\frac{1}{2}\ K_2CO_3$, . .	1·78	1·57	...	...	1·77
$\frac{1}{2}\ Na_2CO_3$, . .	0·987	1·57	...	...	2·00
$\frac{1}{2}\ ZnSO_4$, . .	...	...	1·78	...	1·86

Sentis gives the following equation :—

$$\alpha_s \sqrt[3]{v/u} = (100-n)\alpha_w/100 + \phi$$

where u = volume of 100 molecules of water,

v = volume of the mixture of (100–n) molecules of water with n molecules of the anhydrous salt.

ϕ = A constant, which, between 0° and 30°, appears to be independent of the temperature.

This investigator found that ϕ is sensibly constant for all strengths up to saturation for salts that have a considerable negative heat of solution, but it increases with the concentration for those salts which, when rendered anhydrous, dissolve with an evolution of heat. The limiting value of ϕ/n he finds to be 1·66 dynes per cm. for salts with two radicles and (3/2) times this, *i.e.* 2·49 dynes, for salts with three radicles.

Volkmann gives the following values for k in Quincke's equation :—

$BaCl_2$, . .	0·174	K_2SO_4	0·153
$SrCl_2$, . .	187	Na_2SO_4	152
$CaCl_2$, . .	204	$MgSO_4$	133
$MgCl_2$, . .	197	$K_2N_2O_6$	105
K_2Cl_2, . .	159	$Na_2N_2O_6$	111
Na_2Cl_2, . .	181	K_2CO_3	190
$(NH_4)_2Cl_2$, .	130	Na_2CO_3	112

And Rother gives the following :—

For NaCl, . .	$a_s = 7·357 + 0·1566y$
„ KCl, . .	$7·357 + 0·1666y$
„ Na_2SO_4, . .	$7·357 + 0·1382y$
„ K_2SO_4, . .	$7·357 + 0·1595y$

Valson (about 1870) concluded that the surface tension of salt solutions was a merely additive property, and that the capillary action of each positive and each negative radicle is constant and quite independent of that which may be combined with such radicle. The following are the numbers given by Valson for tubes 0·5 mm. diameter, in which he found a normal solution of ammonium chloride to ascend 60·9 mms. at 15° C.

TABLE LXXIG$_1$.—**Capillary Moduli.**

Radicle.	Equivalent.	Modulus.	Radicle.	Equivalent.	Modulus.
Ammonium, .	18	0·0 mm.	Silver, . . .	108	5·5 mm.
Lithium, . .	7	0·05	Lead, . . .	104	5·9
Sodium, . .	23	1·2	Thallium, . . .	203	7·9
Magnesium, .	12	1·4	Cl in chlorides, . .	35·5	0·0
Calcium, . .	20	1·4	CO_3 in carbonates, .	30	0·5
Potassium, .	39	1·5	NO_3 in nitrates, .	62	1·0
Manganese, .	27·5	2·5	C_2O_5 in bicarbonates,	52	1·1
Iron, . .	28	2·5	SO_4 in sulphates, .	48	1·2
Zinc, . .	32·5	2·7	SO_3 in sulphites, .	40	1·3
Copper, . .	32	2·9	S_2O_3 in thiosulphates,	56	1·4
Strontium, .	44	2·9	Br in bromides, .	80	2·1
Barium, . .	69	3·9	I in iodides, . .	127	3·9
Cadmium, .	56	4·3			

Employing these moduli, we find that the ascent of barium chloride solution should be $60·9 - 3·9 = 57$ mms., which agrees with the value obtained experimentally; for ammonium sulphate $H = 60·9 - 1·2 = 59·7$ mms., and the value obtained by actual experiment is 59·9; for cadmium sulphate we get $H = 60·9 - (4·3 + 1·2) = 55·4$, while experiment gave 56·2 mms. The symbols, equivalents, etc., are printed as given by Valson.

At a later period, working with tubes of the same dimensions, Valson found that for normal solutions the "capillary contents" (*i.e.* height multiplied by the density) is practically constant for many, if not for all, salts; the product DH seems to tend to a limiting value of about 61·7. Of 42 salt solutions examined by this investigator, only three gave lower values than 61·4, and only a similar number exceeded 62.

TABLE LXXI G_2.

	Equivalent.	Chloride.			Bromide.			Iodide.			Sulphate.			Nitrate.		
		H.	D.	DH.	H.	D.	DH.	H.	D.	DH.	H.	D.	DH.	H.	D.	DH
Lithium, ...	7	60·8	1·023	62·1	58·6	1·058	61·9	56·8	1·087	61·7	59·6	1·043	62·1	59·8	1·036	61·9
Magnesium, . . .	12	59·7	1·035	61·8							58·5	1·055	61·7	58·6	1·048	61·4
Ammonium, . . .	18	60·9	1·015	61·8	58·7	1·050	61·6				59·7	1·035	61·8	59·9	1·028	61·6
Calcium, ...	20	59·4	1·042	61·9	57·2	1·077	61·6	55·4	1·106	61·2				58·4	1·055	61·6
Sodium, ...	23	59·7	1·040	62·1	57·5	1·075	61·8	55·7	1·104	61·5	58·5	1·060	62·0	58·7	1·053	61·8
Manganese, . . .	28	58·5	1·052	61·5							57·3	1·072	61·4	57·5	1·065	61·7
Zinc, ...	33	58·2	1·056	61·5							57·2	1·076	61·5			
Potassium, . . .	39	59·4	1·045	62·0	57·2	1·080	61·8	55·4	1·109	61·5	58·2	1·065	62·0	58·4	1·058	61·8
Strontium, . . .	44	57·9	1·070	61·9										56·9	1·083	61·6
Cadmium, . . .	56	57·2	1·078	61·8	55·0	1·113	61·2	53·2	1·142	60·7	56·0	1·098	61·5	56·2	1·091	61·7
Barium, ...	69	57·0	1·088	62·0										56·0	1·101	61·6
Lead, ...	104													54·1	1·133	61·6
Silver, ...	108													54·5	1·133	61·7

H = Height to which the liquid ascends in capillary tubes 0·5 mm. diameter at 15° C.
D = Density of the normal solution at 15° C.

The preceding numbers also agree very closely with the following expression,—

$$H = 118{\cdot}5 - 56{\cdot}8\,D,$$

so that in exchanging one normal solution for another, the alteration in the length of the capillary column is inversely proportional to the change in density.

Röntgen and Schneider, from their investigations on surface tensions and compressibility, calculated the surface tensions of solutions of the iodides, nitrates, bromides, chlorides, hydroxides, sulphates and carbonates of hydrogen, ammonium, lithium, sodium and potassium; they expressed the results in arbitrary units (*hd*), and from these the values of α in mgrms./mm. have been computed.

TABLE LXXIG_3.—A. Concentration 0·7 Normal.

Negative Radicles.	Positive Radicles.									
	H. α		NH_4. α		Li. α		Na. α		K. α	
	R. and S.'s Units.	mgm/mm.	R. and S.'s Units.	mgm/mm.	R. and S.'s Units.	mgm/mm.	R. and S.'s Units.	mgm/mm	R. and S.'s Units.	mgm/mm.
I			112·25	7·72	112·27	7·72	112·55	7·74	112·46	7·73
NO_3	110·60	7·60	112·60	7·74	112·81	7·75	112·88	7·76	112·61	7·74
Br	110 88	7·62	112·89	7·76	112·89	7·76	113·01	7·77	112·78	7·75
Cl	111·12	7·63	113·06	7·77	113·20	7·78	113·20	7·78	113·18	7·78
OH	111·45	7·66	108·66	7·47	113·27	7·79	113·41	7·79	113·45	7·80
SO_4	111·55	7·67	113·99	7·83	114·23	7·85	114·14	7·84	114·09	7·84
CO_3							115·55	7·94	115·44	7·93

B. Concentration 1·5 Normal.

Negative Radicles.	Positive Radicles.									
	H. α		NH_4. α		Li. α		Na. α		K. α	
	R. and S.'s Units.	mgm/mm.	R. and S.'s Units.	mgm/mm.	R. and S.'s Units.	mgm/mm.	R. and S.'s Units.	mgm/mm.	R. and S.'s Units.	mgm/mm.
I			113·14	7·77	113·23	7·78	113·84	7·82	113·58	7·81
NO_3	109·75	7·55	113·86	7·83	114·22	7·85	114·25	7·86	113·92	7·83
Br	110·40	7·59	114·33	7·85	114·43	7·86	114·73	7·88	114·68	7·88
Cl	110·88	7·62	114·48	7·87	115·01	7·90	115·05	7·91	114·79	7·89
OH	111·45	7·66	106·81	7·34	115·21	7·92	115·87	7·96	115·54	7·94
SO_4	112·49	7·73	116·91	8·03	117·61	8·08				
CO_3							117·54	8·07	118·23	8·12

The values of α in milligrammes per millimetre correspond to a temperature of 15° C.

Jäger found the following values, in dynes per cm.[2] at 13°·5 C., for the various solutions:—

Water,			73·035
Solution of	NaCl,	19·9 per cent.,	77·479
„	„	10·4 „	75·179
„	KCl,	20·5 „	75·423
„	„	10·3 „	74·513
„	NH_4Cl,	22·4 „	78·306
„	„	11·3 „	75·668
„	$MgCl_2$,	19·6 „	77·994
„	„	12·3 „	75·654
„	$NaNO_3$,	24·6 „	74·942
„	„	12·4 „	74·355
„	Na_2CO_3,	10·3 „	74·255
„	sugar,	35·2 „	73·511
„	„	25·2 „	73·346

These values correspond very closely to the following empirical expressions, where p denotes the percentage of salt in the solutions:—

$$
\begin{aligned}
\alpha \text{ for NaCl} &= \alpha_w(1+0{\cdot}0_2 25653p+0{\cdot}0_4 24747p^2) \\
\text{„ „ KCl} &= \alpha_w(1+0{\cdot}0_2 23382p-0{\cdot}0_4 36254p^2) \\
\text{„ „ } NH_4Cl &= \alpha_w(1+0{\cdot}0_2 31583p+0{\cdot}0_4 02842p^2) \\
\text{„ „ } MgCl_2 &= \alpha_w(1+0{\cdot}0_2 19907p+0{\cdot}0_4 75182p^2) \\
\text{„ „ } NaNO_3 &= \alpha_w(1+0{\cdot}0_2 20573p-0{\cdot}0_4 46156p^2) \\
\text{„ „ } Na_2CO_3 &= \alpha_w(1+0{\cdot}0_2 162318p) \\
\text{„ „ sugar} &= \alpha_w(1+0{\cdot}0_2 012827p+0{\cdot}0_4 016177p^2)
\end{aligned}
$$

Quincke found the following values (mgms./mm.) of α for solutions of organic substances:—

Solution of	gall	(9%)	(sp. gr. = 1·0133)	α = 5·076
„	„ Venetian soap	(1/4000)	(„ 0·9983)	2·681
„	„ „	(1/400)	(„ 0·9992)	2·672
„	„ „	(1/40)	(„ 1·0009)	2·563
„	„ sugar	(37·7%)	(„ 1·1170)	8·182
„	„ tannin	(10%)	(„ 1·0352)	5·857
„	„ gum arabic	(20%)	(„ 1·0708)	7·603
„	„ isinglass	(very dilute)	(„ 1)	6·790
„	„ gelatine	(very dilute)	(„ 1)	7·277
„	„ agar agar	(very dilute)	(„ 1)	7·842

The results obtained by Dorsey by the "ripple method" are highly instructive and suggestive; they are subjoined without alteration in the hopes that they may be of value in training students to work by this splendid method.

t = temperature of experiment.
n = frequency of tuning-fork employed to produce the ripples.
ρ = density of solution.
λ_1 = observed wave-length in terms of a scale each of whose divisions corresponded to 1·0328 cm.
T_t = surface tension at $t°$ in dynes per cm.
T_{18} = „ „ „ 18° C. „ „ „ „

TABLE LXXIG_4.—Solutions of Sodium Chloride.

Grm. Mols. per Litre.	t° C.	n.	λ_1.	T_t/ρ.	T_t.	T_{18}.
0	16°	63·07	0·4858	73·72	73·64	73·34
0·067	17 ·2		52	44	56	44
14	17 ·8		49	29	58	55
22	18 ·2		43	01	57	60
29	18 ·6		43	01	78	87
0	16 3	63·07	4858	73·72	73·64	38
0·12	16 ·7		52	44	70	50
29	17 ·4		49	29	74·08	99
46	17 ·7		40	72·88	16	74·12
63	18 ·5		37	73	37	45
0	13 ·1	63·07	4865	74·03	73·99	73·25
0·17	13 ·5		59	73·76	74·23	55
33	14 ·1		55	57	74·52	92
51	15 ·0		54	52	75·00	74·54
68	19 ·0		41	72·92	74·83	99
0	16 ·4	62·96	4863	73·67	73·59	73·35
0·088	17 ·0		60	54	72	57
17	17 ·3		55	30	73	62
25	17 ·4		49	01	68	69
0	18 ·6	62·96	4854	73·25	73·14	73·23
0·37	19 ·3		39	72·56	55	75
0·72	19 ·8		25	71·91	91	74·17
1·11	20 ·1		15	71·45	74·53	86
1·46	20		05	70·99	75·02	75·33
0	19 ·3	62·96	4842	72·69	72·57	72·77
0·397	20 ·3		37	47	73·53	73·88
468	20 ·9		37	47	72	74·17
549	21 ·3		33	28	76	27
62	21 ·4		24	71·86	54	06
703	21 ·3		17	55	46	73·97
768	21 ·2		21	73	83	74·32
0	15 ·9	62·96	4860	73·54	73·47	73·15
0·34	16 ·2		52	16	74·11	84
40	16 ·5		50	06	19	96
46	16 ·8		45	72·76	06	88
52	16 ·9		47	92	40	74·23
58	17 ·1		41	65	30	16
64	17 ·2		40	56	38	26
76	17 ·3		40	56	72	61
88	17 ·4		31	19	69	60

TABLE LXXIG_5.—**Solutions of Potassium Chloride.**

Grm. Mols. per Litre.	$t°$ C.	n.	λ_1.	T_t/ρ.	T_t.	T_{18}.
0	18°·6	62·87	0·4854	73·02	72·91	73·00
0·09	18 ·6		61	35	73·49	58
19	18 ·4		58	21	76	82
27	18 ·3		52	72·93	75	80
35	18 ·2		53	98	74·05	74·08
58	18 ·1		55	73·07	52	54
0	18 ·7	62·87	4855	72·84	72·73	72·84
0·338	19 ·3		51	66	73·68	73·88
557	19 ·9		49	57	96	74·25
771	20 ·2		39	11	74·55	89
986	20 ·3		27	71·56	62	98
1·204	20 ·3		23	37	75·11	75·48
0	18 ·0	62·87	4863	73·43	73·33	73·33
0·19	17 ·3		51	72·88	44	33
37	16 ·8		47	69	86	68
55	16 ·4		47	69	74·46	74·21
73	16 ·0		44	55	75·00	69
92	15 ·8		36	19	74·96	62
0	21 ·1	62·78	4860	73·08	72·81	73·28
0·221	20 ·6		48	72·52	73·14	54
446	20 ·3		43	72·29	73·64	99

TABLE LXXIG_6.—**Solutions of Potassium Carbonate,** $\frac{1}{2}$ ($K_2CO_3 + 2H_2O$).

Grm. Mols. per Litre.	$t°$ C.	n.	λ_1.	T_t/ρ.	T_t.	T_{18}.
0	18°·3	62·86	0·4862	73·38	73·28	73·33
0·22	19 ·2		50	72·82	85	74·04
44	19 ·9		33	72·04	97	27
66	20 ·4		13	71·13	90	27
88	20 ·8		02	70·61	74·41	84
0	13 ·7	62·86	4864	73·46	73·41	72·76
0·096	13 ·7		60	73·28	73·81	73·16
294	13 ·6		51	72·86	74·29	62
512	13 ·5		36	72·17	43	74
713	13 ·5		26	71·70	95	74·26
915	13 ·5		12	71·07	75·14	74·45

TABLE LXXIG$_7$.—**Solutions of Sodium Carbonate, $\frac{1}{2}$ ($Na_2CO_3 + 10H_2O$).**

Grm. Mols. per Litre.	t° C.	n.	λ_1.	T_t/ρ.	T_t.	T_{18}.
0	18°·5	62·85	0·4857	73·11	73·00	73·08
0·061	18 ·5		55	02	20	28
187	18 ·1		53	72·92	61	63
310	17 ·6		49	74	95	89
432	17 ·4		40	33	74·04	95
0	17 ·9	62·86	4857	73·14	73·04	73·03
0·115	17 ·6		55	05	42	36
228	17 ·1		48	72·73	54	40
344	16 ·6		48	73	74·02	81
458	16 ·3		38	27	73·99	73
574	15 ·9		37	22	74·40	74·08

TABLE LXXIG$_8$.—**Solutions of Zinc Sulphate, $\frac{1}{2}$ ($ZnSO_4 + 7H_2O$).**

Grm. Mols. per Litre.	t° C.	n.	λ_1.	T_t/ρ.	T_t.	T_{18}.
0	18°·1	62·78	0·4867	73·40	73·30	73·31
0·129	18 ·7		50	72·65	32	43
257	18 ·7		40	72·16	58	69
39	18 ·7		22	71·47	64	75
0	17 ·7	62·78	4864	73·26	73·16	73·12
0·283	18 ·2		32	71·79	36	39
567	18 ·4		04	70·51	65	71
0	18 ·6	62·78	4867	73·40	73·12	73·21
0·115	19 ·6		53	72·76	33	58
173	19 ·7		51	66	48	74
216	19 ·7		45	38	54	80
263	19 ·7		32	71·79	22	48
0	18 ·4	62·78	4866	73·35	73·24	73·31
0·0435	19 ·5		57	72·94	73·07	30
0887	20 ·2		47	47	72·88	38
133	20 ·7		50	61	73·28	69
35	20 ·5		32	71·79	73·71	74·09

TABLE LXXIG$_8$.—*continued.*

Grm. Mols. per Litre.	$t°$ C.	n.	λ_1.	T_t/ρ.	T_t.	T_{18}.
0	18°·3	62·78	0·4868	73·45	73·34	73·39
0·0199	18 ·4		60	73·08	11	17
066	18 ·8		56	72·89	18	30
108	18 ·9		53	76	30	44
152	18 ·7		50	61	42	52
286	18 ·7		41	21	80	90
33	18 ·5		30	71·71	54	62
372	18 ·4		29	65	75	79
414	18 ·3		27	55	87	91
0	14 8	62·85	4870	73·74	73·68	73·20
0·18	15 ·2		48	72·70	72	30
37	15 ·5		39	72·31	74·43	74·05
555	15 ·9		22	71·53	67	35
736	16 ·2		04	70·71	82	54
919	16 ·4		4789	70·03	75·06	81

Traube investigated the behaviour of aqueous solutions of several organic liquids, and the results of his labours are given below. The numbers denote the heights to which the various mixtures ascended in capillary tubes of the same bore.

TABLE LXXIG$_9$.—**Aqueous Solutions of Fatty Acids.**

Concentration. Grms. per Litre.	h.						
	Formic.	Acetic.	Propionic.	Butyric.	Isobutyric.	Isovaleric.	Caproic.
200	72·70	60·68	46·55	36·21			
100	79·16	68·61	53·76	39·78	38·92		
50	84·47	76·06	63·07	48·46	46·75		
25	86·91	81·45	70·56	57·15	54·66	41·87	
12·5	89·05	85·10	77·56	67·07	64·57	53·06	
6·25					72·56	61·77	48·55
3·125					78·58	70·45	58·59

TABLE LXXIG$_{10}$.—**Aqueous Solutions of Alcohols.**

Concentration. Grms. per Litre.	h.						
	Methyl Alcohol.	Ethyl Alcohol.	Propyl Alcohol.	Isopropyl Alcohol.	Butyl Alcohol.	Isobutyl Alcohol.	Isoamyl Alcohol.
200	61·05	48·71	35·07	35·50			
100	71·21	60·96	43·65	44·06			
50	78·04	71·37	54·70	54·60	38·46	40·03	
25	83·46	79·06	65·11	64·11	49·36	51·06	
12·5	87·45	83·74	74·32	72·14	60·45	62·07	45·57
6·25					69·07	71·20	56·48
3·125					76·64	77·06	67·08

From the preceding and some further investigations Traube compiled the following table for convenience of comparison.

Substance.	Grms. per Litre.	h.	Substance.	Grms. per Litre.	h.
Propionic acid, . .	100	53·76	Triethyl amine . .	40	41·26
Lactic ,, .	100	71·51	Propionitril, . . .	40	63·19
Butyric ,, . .	100	39·78	Ethyl ether, . . .	40	53·33
Isobutyric ,, . .	100	38·92	Oxalic ,, . . .	20	64·27
Oxyisobutyric,, . .	100	68·11	Anilin, ...	20	66·45
Ethyl alcohol, . .	100	60·96	Butyl alcohol, . .	12·5	60·45
Ethylene ,, . . .	100	85·84	Isobutyl ,, . .	12·5	62·07
Propyl ,, . .	100	43·65	Trimethyl carbinol, .	12·5	68·11
Isopropyl ,, . .	100	44·06	Isoamyl alcohol, . .	12·5	45·57
Glycerol, . . .	100	90·03	Dimethylethyl carbinol,	12·5	60·02
Acetaldehyde, . .	50	75·50	Propyl alcohol, . .	12·5	74·32
Paraldehyde, . .	50	58·36	Allyl ,, . .	12·5	81·57
Propylaldehyde, . .	50	62·52	Propyl acetate, . .	12·5	55·54
Acetone, . . .	50	71·47	Allyl acetate, . .	12·5	64·25
Allyl alcohol, . .	50	66·46	Mercaptan, . . .	5	85·30
Diethyl amine, . .	40	57·73	Benzaldehyde, . .	2·5	83·33

Putting m for the molecular weight of the organic acids, the values of h/m work out as follows :—

Grms. per Litre.	h/m.						
	Formic.	Acetic.	Propionic.	Butyric.	Isobutyric.	Isovaleric.	Caproic.
200	1·580	1·011	0·629	0·411			
100	1·721	1·144	0·726	452	0·442		
50	1·836	1·268	0·852	551	531		
25	1·889	1·358	0·954	649	621	0·410	
12·5	1·936	1·418	1·048	762	734	520	
6·25				847	825	606	0·411
3·125				910	893	691	0·499

From the preceding Traube concludes that, with two substances of molecular weights m_α and m_β respectively, if h_α and h_β represent the heights to which solutions of the same concentration of the two will ascend in the same capillary tube, and if $h^1{}_\alpha$ and $h^1{}_\beta$ be the heights corresponding to another equal concentration, then—

$$\frac{h_\alpha - h^1{}_\alpha}{h_\beta - h^1{}_\beta} = \frac{m_\alpha}{m_\beta}.$$

TABLE LXXIG*.—**Capillarity Constants for Aqueous Solutions.** (A) Quincke's Experiments.

Substance.	Specific Gravity.	Weight of Substance dissolved in 100 parts water.	Results with Capillary Tubes.			Results with Air Bubbles.			Contact Angle.	
			Cohesion (a)		Specific Cohesion (a^2).	Cohesion a		Specific Cohesion. a^2.	From Tubes. ϑ.	From Bubbles. θ.
			Mgms. per mm.	Dynes per cm.		Mgms. per mm.	Dynes per cm.			
Water,	1	0	7·35	72·122	14·70	8·415	82·572	16·83	° ′	29° 3′
Hydrogen chloride, HCl,	1·0084	1·71	7·425	72·858	14·72	8·014	78·637	15·89	22 5	23 18
" "	0615	14·55	7·256	71·200	13·67	7·790	76·439	14·68	21 19	17 7
" "	1084	28·31	7·193	70·581	12·98	7·938	77·992	14·32	25 1	22 50
" "	1929	64·57	6·771	66·440	11·39	7·379	72·406	12·38	23 25	22 23
Lithium chloride, LiCl,	0595	11·14	7·796	76·498	14·72	8·810	86·448	16·96	27 46	31 26
" "	1233	25·14	8·403	82·454	14·97	9·556	93·768	17·01	28 21	30 48
Ammonium chloride, NH_4Cl,	0360	13·30	7·643	74·997	14·75	8·587	84·260	16·58	27 7	31 9
" "	0758	35·18	8·086	79·344	15·03	8·907	87·400	16·56	24 47	32 43
Sodium chloride, NaCl,	0865	13·27	7·724	75·792	14·22	8·659	84·966	15·94	26 53	22 50
" "	1543	25·61	8·038	78·873	13·93	8·832	86·664	15·30	24 30	14 51
" "	1574	26·22	8·083	79·314	13·97	8·892	87·253	15·36	24 37	31 50
" "	2063	37·55	8·418	82·602	13·97	9·324	91·492	15·46	25 28	27 47
Potassium chloride, KCl,	0487	8·03	7·430	72·907	14·17	8·335	81·787	15·90	26 56	24 7
" "	0932	16·13	7·667	75·232	14·03	8·494	83·356	15·54	25 29	29 13
" "	1472	27·36	7·848	77·009	13·69	8·564	84·034	14·93	23 37	1 50
" "	1709	32·83	8·008	78·579	13·68	8·756	85·918	14·95	23 52	13 42
Magnesium chloride, $MgCl_2$,	1385	18·75	8·003	78·529	14·05	8·945	87·773	15·71	26 30	9 7
" "	2824	43·37	9·020	88·509	14·04	10·21	99·186	15·93	27 56	24 28
Calcium chloride, $CaCl_2$,	0813	10·33	7·627	74·840	14·11	8·456	82·985	15·64	25 35	26 55
" "	1632	22·01				9·145	89·735	15·72		25 6

” ” . .	2128	28·20	8·322	81·650	13·72	9·391	92·149	15·48	27 36	32 55
” ” . .	3078	46·62				9·813	96·290	15·00		20 52
” ” . .	4197	70·61	9·656	94·750	13·64	10·327	101·334	14·55	20 44	29 35
Strontium chloride, $SrCl_2$, . .	0718	7·27	7·484	73·437	13·97	8·357	82·003	15·59	26 27	28 45
” ” . .	1303	15·83	7·613	74·703	13·47	8·432	82·749	14·92	25 26	26 22
” ” . .	2289	29·11	7·893	77·450	12·85	8·690	85·271	14·14	24 43	21 57
” ” . .	3622	49·08	8·422	82·641	12·36	9·236	90·628	13·56	24 14	19 16
Barium chloride, $BaCl_2$, . .	0620	7·11	7·475	73·348	14·07	8·410	82·523	15·84	27 16	27 36
” ” . .	1306	15·38	7·674	75·301	13·57	8·541	83·809	15·11	26 4	28 38
” ” . .	2043	24·76	7·672	75·282	12·78	8·716	85·526	14·48	28 19	32 7
” ” . .	2501	30·53	7·804	76·577	12·49	8·827	86·615	14·12	27 51	30 50
Manganese chloride, $MnCl_2$, .	1876	25·62	7·938	77·892	13·37	8·886	87·194	14·97	26 43	20 27
” ” .	3345	49·61	8·521	83·512	12·77	9·523	93·444	14·27	26 29	23 21
Ferric chloride, Fe_2Cl_6, . .	2126	41·77	8·011	78·608	13·21	9·283	91·089	15·31	30 20	27 36
” ” . .	4135	66·43	8·549	83·787	12·10	9·855	96·702	13·95	29 48	24 25
Hydrogen sulphate, H_2SO_4, .	0492	8·43	7·385	72·465	14·04	8·269	81·140	15·77	26 43	29 21
” ” .	2318	45·14	7·741	75·959	12·57	8·395	82·376	13·84	22 47	28 33
” ” .	3621	85·61	7·810	76·636	11·47	8·579	84·181	12·60	24 25	31 53
” ” .	5197	161·1	7·675	75·311	10·10	8·335	81·787	10·97	22 56	28 15
” ” .	8371	180·4	5·992	58·797	6·52	5·762	56·540	6·27		20 17
Sodium sulphate, Na_2SO_4, . .	0526	6·12	7·532	73·908	14·31	7·865	77·175	14·94	16 44	11 26
” ” . .	1564	19·85	7·689	75·448	13·30	8·002	78·520	13·86	16 7	24 0
Potassium sulphate, K_2SO_4, . .	0251	3·17	7·490	73·496	14·61	8·168	80·149	15·94	23 30	23 27
” ” . .	0781	10·00	7·460	73·201	13·84	8·339	81·826	15·47	26 33	23 32
Magnesium sulphate, $MgSO_4$, .	1390	14·99	7·605	74·624	13·32	8·429	82·710	14·79	25 33	21 18
” ” .	2993	35·98	8·137	79·844	12·53	9·278	91·040	14·28	28 43	19 19
Zinc sulphate, $ZnSO_4$, . .	0910	9·28	7·487	73·466	13·72	8·292	81·365	15·20	25 28	24 1
” ” . .	2187	22·59	7·499	73·584	12·30	8·472	83·132	13·91	27 44	20 40
” ” . .	4168	45·88	7·971	78·215	11·26	8·992	88·234	12·69	27 33	27 33
” ” . .	4539	50·59	8·091	79·393	11·13	9·020	88·509	12·41	26 14	25 41

Substance.	Specific Gravity.	Weight of Substance dissolved in 100 parts aqua.	Results with Capillary Tubes. Cohesion (a) Mgms. per mm.	Results with Capillary Tubes. Cohesion (a) Dynes per cm.	Results with Capillary Tubes. Specific Cohesion (a^2).	Results with Air Bubbles. Cohesion a Mgms. per mm.	Results with Air Bubbles. Cohesion a Dynes per cm.	Results with Air Bubbles. Specific Cohesion a^2.	Contact Angle. From Tubes ϑ.	Contact Angle. From Bubbles θ.
Copper sulphate, $CuSO_4$, . .	1·0071	0·58	7·382	72·436	14·66	8·017	78·667	15·92	22° 55′	° ′
,, ,, . .	0664	6·40	7·458	73·182	13·98	8·666	85·035	16·25	30 36	30 9
,, ,, . .	1144	11·61	7·504	73·633	13·47	8·267	81·120	14·84	24 49	4 21
,, ,, . .	1859	19·64	7·550	74·084	12·73	8·295	81·395	13·99	24 30	22 5
Hydrogen nitrate, HNO_3, . .	0110	2·20	7·293	71·563	14·43	8·026	78·755	15·88	24 40	26 29
,, ,, . .	0915	18·08	7·180	70·454	13·15	7·733	75·880	14·17	21 49	28 9
,, ,, . .	2068	50·10	6·992	68·609	11·58	7·378	72·397	12·22	18 38	26 18
Sodium nitrate, $NaNO_3$, . .	2049	37·27	7·768	76·224	12·89	8·543	83·828	14·19	24 37	12 15
,, ,, . .	3811	84·88	8·299	81·434	12·02	9·406	92·296	13·56	28 5	20 43
Potassium nitrate, KNO_3, . .	0988	17·46	7·462	73·221	13·58	8·205	80·512	14·93	24 36	16 1
,, ,, .	1398	25·80	7·525	73·839	13·20	8·184	80·306	14·36	23 9	19 17
Sodium carbonate, Na_2CO_3, .	1213	12·90	7·674	75·301	13·69	8·592	84·309	15·33	26 44	25 1
,, ,, .	1670	18·40	7·712	75·674	13·21	8·626	84·643	14·79	26 36	28 15
Potassium carbonate, K_2CO_3, .	1631	20·60	7·828	76·812	13·52	8·477	83·181	14·57	22 36	
,, ,, .	2342	29·72	7·995	78·451	12·96	8·796	86·311	14·26	24 39	14 48
,, ,, .	2502	34·05	8·054	79·030	12·88	9·111	89·402	14·58	27 53	14 9
,, ,, .	2553	34·88	8·165	80·119	13·01	9·129	89·578	14·52	26 34	16 8
,, ,, .	4444	72·63	9·386	92·100	13·00	10·30	101·069	14·26	24 18	10 57
,, ,, .	5667	104·9	10·81	106·073	13·80	11·53	113·138	14·72	20 21	15 49
Ammonia, NH_3, . . .	0·9985	0·41	7·275	71·386	14·57					
,, ,, . . .	9976	0·64	7·207	70·719	14·57	8·000	78·500	16·04	25 45	27 12

,, ,, . . .	9798	5·04	6·807	66·794	13·89	7·137	70·032	14·57	17 30	
,, ,, . . .	9487	14·72	6·344	62·250	13·36	6·764	66·172	14·26	20 17	22 51
,, ,, . .	9390	18·64	6·246	61·289	13·30					
Cane sugar, ...	1·1170	37·67	7·496	73·555	13·42	8·182	80·286	14·65	23 37	24 58
,, ...	2359	102·2	7·643	74·997	12·37	8·429	82·710	13·64	24 54	26 43
Egg albumen, ...	0384					5·370	52·693	10·40		18 11
Tannic acid, ...	0352	10	7·250	71·141	14·01	5·857	57·472	11·31		25 32
Gum arabic, ...	0708	20				7·603	74·604	14·20		29 3
Arabin, ...	0004	0·5	7·306	71·690	14·61	8·261	81·061	16·52	27 50	27 1
Alcohol, C_2H_5OH, . . .	0·9973	1·19	6·866	67·373	13·77	8·000	78·500	16·04	30 53	31 17
,, ,, . . .	9852	9·84	5·066	49·710	10·29	5·657	55·509	11·48	26 23	28 19
,, ,, . . .	9110	111·68	2·828	27·750	6·21	2·947	28·917	6·47	16 21	15 49
,, . . .	7904	∞	2·294	22·510	5·80	2·354	23·098	5·96	12 57	15 3

TABLE LXXIg*.—**Capillarity Constants of Aqueous Solutions.**

(B) P. Volkmann's Experiments.

E = "Equivalent," according to Volkmann's nomenclature, really double the true chemical equivalent of the substance.

σ = Specific gravity of liquid at temperature of the experiments, water at 4° C. being taken as 1.

S = Weight of anhydrous substance dissolved in every 100 grms. of water (according to Gerlach's tables).

y = Number of salt "Equivalents" corresponding to every 100 "Equivalents" of water in solution.

a^2 and α with usual import.

Substance and Temperature.	E	σ	S	y	a^2	α Mgms. per mm.	α Dynes per cm.
$2NH_4Cl$, 16° C.,	107	1·0758	35·94	6·044	15·36	8·26	81·05
		0535	22·42	3·770	15·21	8·01	78·60
		0281	10·71	1·802	15·04	7·73	75·85
15° C. to 16° C.,		0750	35·14	5·910	15·37	8·26	81·05
		0388	14·98	2·520	15·14	7·86	77·13
2NaCl, 20° C.,	117	1932	34·19	5·262	14·09	8·42	82·62
		1596	27·29	4·200	14·14	8·20	80·46
		1074	16·82	2·588	14·25	7·89	77·42
		0720	11·25	1·732	14·44	7·74	75·95
		0360	5·54	0·853	14·70	7·61	74·67
15° C. to 16° C.,		1987	34·87	5·367	14·13	8·47	83·11
		1154	18·51	2·849	14·36	8·01	78·60
		0463	6·91	1·067	14·71	7·695	75·51
2KCl, 15° C. to 16° C.,	149	1696	32·73	3·954	13·88	8·12	79·68
		1011	17·95	2·173	14·26	7·85	77·03
		0463	7·75	0·963	14·66	7·67	75·26
$MgCl_2$, 15° C. to 16° C.,	95	2338	34·60	6·553	14·31	8·83	86·64
		1694	27·76	4·499	14·29	8·355	81·98
		0840	10·95	2·073	14·50	7·86	77·13
		0362	4·59	0·869	14·76	7·65	75·07
$CaCl_2$, 19° C.,	111	3511	56·19	9·113	13·78	9·31	91·35
		2773	41·69	6·761	13·84	8·84	86·74
		1789	24·98	4·052	13·94	8·22	80·66
		0971	12·80	2·077	14·24	7·81	76·64
		0540	7·00	1·135	14·44	7·61	74·67
		0179	2·41	0·392	14·75	7·51	73·69
15° C. to 16° C.,		3430	53·76	8·720	13·83	9·29	91·16
		2269	32·34	5·245	13·97	8·57	84·09

TABLE LXXIG*—*continued.*

Substance and Temperature.	E	σ	S	y	a^2	α Mgms. per mm.	α Dynes per cm.
		1·1136	14·87	2·412	14·27	7·95	78·01
		0552	6·96	1·129	14·61	7·71	75·65
$SrCl_2$, . . .	158	3114	41·35	4·698	12·81	8·40	82·43
15° C. to 16° C., .		2282	29·13	3·308	13·19	8·10	79·48
		1204	14·67	1·666	13·90	7·79	76·44
		0567	6·70	0·761	14·45	7·635	74·90
$BaCl_2$, . . .	208	2561	31·88	2·759	12·60	7·91	77·62
21° C., . .		1951	24·01	2·078	13·04	7·79	76·44
		1190	14·29	1·237	13·71	7·67	75·26
		0544	6·53	0·565	14·24	7·51	73·69
15° C. to 16° C., .		2820	35·13	3·041	12·51	8·02	78·70
		1822	21·95	1·900	13·24	7·83	76·83
		0947	11·16	0·966	14·03	7·68	75·36
		0497	5·80	0·502	14·49	7·605	74·62
$2NaNO_3$, . . .	170	3022	62·61	6·583	12·58	8·19	80·36
12° C., . .		2301	43·77	4·635	13·05	8·03	78·79
		1311	20·18	2·137	13·86	7·84	76·93
15° C. to 16° C., .		3623	80·18	8·491	12·37	8·43	82·72
		2338	44·98	4·763	13·02	8·03	78·79
		1067	18·17	1·924	14·01	7·75	76·05
		0490	7·93	0·839	14·53	7·62	74·77
$2KNO_3$, . . .	202	1263	22·97	2·044	13·75	7·74	75·95
14° C., . .		0900	15·82	1·408	14·06	7·66	75·16
		0466	7·88	0·701	14·55	7·61	74·67
15° C. to 16° C., .		1347	24·91	2·217	13·63	7·73	75·85
		0784	13·67	1·216	14·13	7·62	74·77
		0411	6·96	0·619	14·59	7·595	74·53
Na_2CO_3, . . .	106	1329	14·39	2·444	13·74	7·78	76·34
14° C. to 15° C., .		0605	6·19	1·051	14·39	7·63	74·87
		0283	2·84	0·482	14·73	7·57	74·28
K_2CO_3, . . .	138	3575	53·76	7·016	13·13	8·91	87·43
15° C., . .		2674	37·07	4·838	13·19	8·36	82·03
		1576	19·96	2·605	13·71	7·94	77·91
		0816	9·77	1·275	14·28	7·72	75·75
		0400	4·69	0·612	14·61	7·60	74·58
15° C. to 16° C., .		4145	65·95	8·607	13·09	9·26 (?)	90·86 (?)
		3254	47·49	6·198	13·08	8·67	85·07

TABLE LXXIα*—*continued.*

Substance and Temperature.	E	σ	S	y	α^2	α Mgms. per mm.	α Dynes per cm.
		1·2314	31·13	4·063	13·31	8·19	80·36
		1227	15·12	1·974	13·92	7·81	76·64
		0562	6·61	0·862	14·44	7·63	74·87
Na_2SO_4, . . .	142	1119	13·66	1·732	13·95	7·76	76·15
15° C. to 16° C., .		0781	9·35	1·185	14·24	7·68	75·36
		0329	3·83	0·486	14·68	7·58	74·38
K_2SO_4, . . .	174	0744	9·91	1·026	14·24	7·65	75·07
15° C. to 16° C., .		0360	4·70	0·486	14·66	7·59	74·48
$MgSO_4$, . . .	120	2744	32·01	4·802	12·81	8·16	80·07
15° C. to 16° C., .		1497	16·26	2·439	13·52	7·77	76·24
		0680	7·08	1·062	14·29	7·63	74·87
$CuSO_4$, . . .	159·5	1775			13·09	7·71	75·65
15° C. to 16° C., .		1189			13·64	7·63	74·87
		0611			14·28	7·58	74·38
		0276			14·69	7·55	74·08
$ZnSO_4$, . . .	161	3981			11·69	8·17	80·17
15° C., . .		2830			12·30	7·89	77·42
		1798			13·10	7·73	75·85
		1039			13·82	7·63	74·87
		0400			14·54	7·56	74·18
English oil of vitriol, .		8278			6·76	6·18(?)	60·64(?)
15° C., . .		6657			8·44	7·03(?)	68·98(?)
		4453			10·81	7·81	76·64
		2636			12·37	7·815	76·68
Hydrochloric acid, .		1190			12·90	7·22	70·85
		0887			13·42	7·305	71·68
		0625			13·83	7·35	72·12
		0242			14·41	7·38	72·42

By taking the values of S as abscissæ, and the corresponding values of α as ordinates, Volkmann found that he obtained points on a curve which approximately conforms to the equation ;—

$$xy = \alpha - 7·50,$$

where y has the same value as in the table. The following are the instances given by him :—

$2NaCl$	$xy = a - 7{\cdot}44$; $x = 0{\cdot}181$	$2NaNO_3$	$xy = a - 7{\cdot}55$; $x = 0{\cdot}102$
	$xy = a - 7{\cdot}50$; $x = 0{\cdot}181$		$xy = a - 7{\cdot}50$; $x = 0{\cdot}111$
$2NH_4Cl$	$xy = a - 7{\cdot}49$; $x = 0{\cdot}130$	$2KNO_3$	$xy = a - 7{\cdot}53$; $x = 0{\cdot}102$
	$xy = a - 7{\cdot}50$; $x = 0{\cdot}131$		$xy = a - 7{\cdot}50$; $x = 0{\cdot}105$
$2KCl$	$xy = a - 7{\cdot}50$; $x = 0{\cdot}160$	Na_2CO_3	$xy = a - 7{\cdot}51$; $x = 0{\cdot}112$
$MgCl_2$	$xy = a - 7{\cdot}50$; $x = 0{\cdot}197$	K_2CO_3	$xy = a - 7{\cdot}50$; $x = 0{\cdot}190$
$CaCl_2$	$xy = a - 7{\cdot}45$; $x = 0{\cdot}202$		$xy = a - 7{\cdot}50$; $x = 0{\cdot}191$
	$xy = a - 7{\cdot}50$; $x = 0{\cdot}204$	Na_2SO_4	$xy = a - 7{\cdot}50$; $x = 0{\cdot}153$
$SrCl_2$	$xy = a - 7{\cdot}50$; $x = 0{\cdot}187$	K_2SO_4	$xy = a - 7{\cdot}50$; $x = 0{\cdot}152$
$BaCl_2$	$xy = a - 7{\cdot}43$; $x = 0{\cdot}174$	$MgSO_4$	$xy = a - 7{\cdot}50$; $x = 0{\cdot}133$
	$xy = a - 7{\cdot}50$; $x = 0{\cdot}174$		

The different values for the same substance are the results of different sets of experiments.

Rodenbeck's investigations with mixtures of two liquids, (alcohol and water; petroleum and chloroform; alcohol and chloroform; chloroform and ether; ether and petroleum), showed that if $a \equiv$ capillary constant of the mixture, a_1, $a_2 \equiv$ capillary constant of each constituent, v_1 and $v_2 \equiv$ volume of each constituent in the mixture, then

$$a = \frac{a_1 v_1 + a_2 v_2}{v_1 + v_2}.$$

Duclaux found that if aqueous solutions of two alcohols, or of two fatty acids, have the same surface tension, the percentage composition of the two solutions will have a constant ratio; the mean values for this ratio he found to be for—

Methyl alcohol/amyl alcohol,	33	Formic acid/acetic acid,	3
Ethyl alcohol/amyl alcohol,	17	Butyric acid/acetic acid,	0·10
Propyl alcohol/amyl alcohol,	9·2		
Butyl alcohol/amyl alcohol,	2·7		
Capryl alcohol/amyl alcohol,	0·061		

This means that a solution containing 1 per cent. of butyric acid will have the same surface tension as one containing 10 per cent. of acetic acid, etc.

Surface Tension between Two Liquids.

When a solid body (c) is in contact with two immiscible liquids a and b, which are also in contact with each other, if ϑ represent the angle made by the surface of c with that separating a and b, and if

$a_{ab} \equiv$ surface tension between a and b,
$a_{ac} \equiv$,, ,, a and c,
$a_{bc} \equiv$,, ,, b and c,

then

$$\cos \vartheta = \frac{a_{bc} - a_{ac}}{a_{ab}};$$

or

$$a_{ab} = (a_{bc} - a_{ac}) / \cos \vartheta.$$

Quincke gives the following values for the liquids mentioned :—

Liquids.		α_a	α_b	α_{ab}
Mercury,	Solution of $Na_2S_2O_3$ ($\sigma=1\cdot125$),	55·03	7·90	45·11
,,	Water,	55·03	8·25	42·58
,,	Alcohol ($\sigma=0\cdot791$),	55·03	2·60	40·71
,,	Chloroform,	55·03	3·12	40·71
,,	Solution of HCl ($\sigma=1\cdot1$),	55·03	7·15	38·41
,,	Carbon disulphide,	55·03	3·27	37·97
,,	Olive oil,	55·03	3·76	34·19
,,	Petroleum ($\sigma=0\cdot798$),	55·03	3·23	28·94
,,	Turpentine,	55·03	3·03	25·54
Water,	Carbon disulphide,	8·25	3·27	4·26
,,	Petroleum,	8·25	3·23	3·83
,,	Chloroform,	8·25	3·12	3·01
,,	Olive oil,	8·25	3·76	2·09
,,	Turpentine,	8·25	3·03	1·18
Olive oil,	Alcohol,	3·76	2·60	0·23

If in the last equation c represents a fluid, *i.e.* a gas or a liquid, the whole expression will require considerable modification. If c denote air, a and b any two liquids—say a drop of b on the surface of a—and if

$\theta_1\equiv$the angle between the surface separating a from c and that separating b from c outside both liquids;
$\theta_2\equiv$the angle between the surface separating a from b and that separating b from c;
$\theta_3\equiv$the angle between the surface separating a from b and that separating a from c;
$\alpha_{ab}\equiv$surface tension between a and b;
$\alpha_{ac}\equiv$surface tension between a and c;
$\alpha_{bc}\equiv$surface tension between b and c;

then $$\alpha_{ac}/\sin\theta_2=\alpha\sin\theta_3=\alpha_{ab}/\sin\theta_1,$$

if there exist a state of equilibrium, and the three magnitudes α_{ac}, α_{bc} and α_{ab} may be represented by the three sides of a plane triangle, and the sum of any two of them must be greater than the third. So far, no instance has been observed where three fluid surfaces meeting along a common line can be in equilibrium—one of the three tensions α_{ac}, α_{bc} and α_{ab} being always greater than the sum of the other two. One pure liquid would always spread over the whole exposed surface of another; thus, as shown by Quincke, a drop of pure water will spread over the surface of pure mercury.

Watson found the following values for α in dynes/cm. at 0° C. :—

Water/air,	76·62	77·59
Mercury/air,	439·07 (?)	487·04
Petroleum/air,	26·45	
Benzol/air,	23·05	
Water/petroleum,		35·38
Water/benzol,		33·79
Mercury/water,	367·90	375·10
Mercury/alcohol,	354·67	368·63

Here we see water/air > water/petroleum + petroleum/air ; the same thing is observable from Quincke's numbers already given.

TABLE LXXIH.

In 1888 Quincke found the following values for the surface tension of the substances named against air (α_a), and against water (α_{ab}) or other liquid where stated.

Liquid.	Specific Gravity.	α_a	α_{ab}
Soda solution, 0·25 per cent.,	1	8·418	0
Water,	1	8·253	0
Glycerol,	1·2535	7·348	0
Rubsen oil,	0·9151	3·348	1·564
Rapeseed oil,	9130	3·340	1·700
Olive oil,	9152	3·760	2·296
Almond oil,	9173	3·515	2·370–1·761
Cod liver oil,	9251	3·391	0·878–0·700
Castor oil,	9633	3·830	1·624
Almond oil + chloroform,	1·0123		1·892–0·622
Chloroform,	1·4878	3·120	3·010
Carbon disulphide,	1·2687	3·274	4·256
Benzol,	0·8985	3·123	1·969
Petroleum,	7977	3·233	3·834
Turpentine,	8867	3·033	1·177
Alcohol,	7904	2·354	0
Ether,	7200	1·740	1·255
Egg albumen,	1·0365	5·934	0
„ „	1·0384	5·370 to	0
„ „		4·913	0
Aqueous solution of gall (9 per cent.),	1·0133	5·076	0
„ „ Venetian soap (1/4000),	0·9983	2·681	0
„ „ „ (1/400),	0·9992	2·672	0
„ „ „ (1/40),	1·0009	2·563	0
„ „ sugar, 37·7 per cent.,	1·1170	8·182	0
„ „ tannic acid, 10 per cent.,	1·0352	5·857	0
„ „ gum arabic, 20 per cent.,	1·0708	7·603	0
„ „ isinglass, very dilute,	1	6·790	0
„ „ gelatine, very dilute,	1	7·277	0
„ „ agar agar, very dilute,	1	7·842	0
Rapeseed oil/egg albumen,			0·710
„ „ /glycerol,			1·415
„ „ /aqueous solution of isinglass,			2·140–1·688
Olive oil/diluted alcohol,			0·693
Almond oil/egg albumen,			0·701
„ /NaCl solution, 1 per cent.,			1·261
Almond oil + $CHCl_3$/soda solution,			0·678–0·119
„ „ /soap solution,			0·257
Cod liver oil/NaCl solution, 1 per cent.,			0·470
„ „ /egg albumen,			0·400

This investigator found that the surface tension was practically *nil* between the following pairs of liquids:—

Alcohol, alcoholic solution; alcohol, ether; alcohol, turpentine; benzol, chloroform; benzol, rapeseed oil; glycerol, olive oil; glycerol, almond oil; glycerol, cod liver oil; carbon disulphide, ether; carbon disulphide, benzol; carbon disulphide, chloroform; carbon disulphide, olive oil; carbon disulphide, turpentine; petroleum, rapeseed oil; turpentine, olive oil; water, aqueous solutions.

Cantor (1892) gives the following values for the surface tensions between

Mercury and benzol	at 20° C., 34·83 mgr./mm.
,, ,, ,,	,, 72° C., 28·45
,, ,, amyl alcohol	,, 25° C., 26·67

TABLE LXXII.—Surface Tension of Fused Metals, etc.

Note.—Where no numbers are given in the temperature column it is to be understood that the experiments were conducted at or very close to the fusion point of the substance.

Substance.	Temperature $t°$ C.	Specific Gravity.	a^2.	α. mgms./mm.	α. dynes/cm.	Method.	Authority.
Antimony,			7·63			Falling drops	Quincke
,,			7·8	38·93	382·01	,,	,,
Bismuth,			8·02			,,	,,
,,	271°	10·004	8·755	43·78	429·60	Flattened drops	Siedentopf
,,	346		8·678	43·017	422·11	,,	,,
,,	511	9·716	8·5088	41·336	405·62	,,	,,
Bromine,			3·90			Falling drops	Quincke
Cadmium,			17·7	70·65	693·27	,,	,,
,,			16·84			,,	,,
,,	312	7·989	21·25	84·85	832·82	,,	,,
,,	318		21·24	84·85	832·61	Flattened drops	Siedentopf
,,	365	7·9252	20·991	83·18	816·22	,,	,,
,,	431	7·8356	20·633	80·835	793·21	,,	,,
Cobalt,			6·708			Drops	Herzfeld
,,			6·200			Bubbles	,,
Copper,			15·4			Falling drops	Quincke
Gold,			11·71			,,	,,
,, (pure),			15·4			,,	,,
,, (0·5% imp.),			6·90	62·24	610·74	,,	Heydweiler
Iron (cast),			25·8			,,	Quincke
,, ,,			27·1			,,	,,
,, ,,			9·80			Drops	Herzfeld
,, ,,			5·712			Bubbles	,,
Lead,			8·34			Falling drops	Quincke
,,			8·6	45·66	447·05	,,	,,
,,	335	10·645		48·2	472·97	Ripples	Grunmach
,,	325	10·645	9·778	51·94	509·67	Flattened drops	Siedentopf
,,	389	10·543	9·678	51·02	500·64	,,	,,
,,	498	10·395	9·498	49·369	484·44	,,	,,
Mercury,			8·65			Falling drops	Quincke
,,	− 39	13·69	6·767	46·29	454·23	,,	Siedentopf
,,	− 39			40		Ripples	Grunmach
Nickel,			13·359		392·51	,,	Herzfeld
,,			9·303			,,	,,

TABLE LXXII.—*continued.*

Substance.	Temperature t° C.	Specific Gravity.	a^2.	α. mgms./mm.	α. dynes/cm.	Method.	Authority.
Palladium,			25·26			Falling drops	Quincke
Phosphorus,			4·58			,,	,,
Platinum,			17·86			,,	,,
Potassium,			85·74			,,	,,
Selenium,			3·42			,,	,,
Silver,			8·55			,,	,,
,,			15·9			,,	,,
,,			10·16			,,	Gradenwitz
,,			13·779			,,	,,
Sodium,			52·97			,,	Quincke
Sulphur,			4·28			,,	,,
,,			17·1	59·85	587·29	,,	,,
Tin,			16·75			,,	,,
,,	226°		18·835			,,	Gradenwitz
,,	226		10·543			,,	,,
,,	240	6·988		35·9	352·28	Ripples	Grunmach
,,	226		17·87	62·43	612·61	Flattened drops	Siedentopf
,,	277	6·947	17·72	61·56	604·07	,,	,,
,,	290	6·937	17·66	61·26	601·12	,,	,,
,,	432	6·824	17·58	59·99	583·66	,,	,,
,,	513	6·759	17·026	57·54	564·62	,,	,,
Zinc,			25·41			Falling drops	Quincke
Rose's alloy,	145			35·0	343·45	Ripples	Grunmach
Wood's ,,	145			34·5	338·54	,,	,,
Lipowitz's alloy,	160			33·4	327·74	,,	,,
$PbSn_3$,	215			39·4	386·62	,,	,,
80% Sn + 20% Bi,	195		15·9			Flattened drops	Siedentopf
,, ,,	225		15·498			Ripples	Grunmach
,, ,,	339		15·306			,,	,,
62·5% Sn + 37·5% Bi,	140		14·6			,,	,,
,, ,,	266		14·368			,,	,,
,, ,,	407		14·123			,,	,,
53·1% Sn + 46·9% Bi,	140		13·4			,,	,,
,, ,,	175		13·34			,,	,,
,, ,,	296		13·136			,,	,,
37% Sn. + 63% Bi,	140		12·25			,,	,,
,, ,,	242		11·953			,,	,,
,, ,,	373		11·681			,,	,,
19·7% Sn + 80·3% Bi,	225		10·6			,,	,,
,, ,,	281		10·514			,,	,,
,, ,,	417		10·282			,,	,,
Cane sugar,			8·53			Drops	Quincke
Grape sugar,			9			,,	,,
Pectin sugar,			9·18			,,	,,
Spermaceti,			7·89			,,	,,
Paraffin,			8·14			,,	,,
Wax,			7·06			,,	,,
Glass,			15·57			,,	,,
Barium chloride,			8·29			,,	,,
Borax,			17·28			,,	,,
Boron oxide,			9·86			,,	,,
Calcium chloride,			9·49			,,	,,
Lithium carbonate,			7·39			,,	,,
Lithium chloride,			8·53			,,	,,
Potassium acetate,				4·363	42·81	,,	Traube
,, ,,				4·519	44·34	,,	,,

TABLE LXXII.—*continued.*

Substance.	Temperature $t°$ C.	Specific Gravity.	a^2.	α. mgms./mm.	α. dynes/cm.	Method.	Authority.
Potassium arsenate (meta), .				15·426	151·37	Drops	Traube
,, bromate, .				9·739	95·57	,,	,,
,, bromide, .				9·505	93·40	,,	,,
,, ,, .			4·49			,,	Quincke
,, carbonate, .				17·140	168·19	,,	Traube
,, ,, .			16·33			,,	Quincke
,, ,, .			14·82			,,	,,
,, chlorate, .				9·038	88·69	,,	Traube
,, chloride, .				10·284	101·91	,,	,,
,, ,, .			8·76			,,	Quincke
,, chromate, .				13·868	136·08	,,	Traube
,, dichromate,				13·790	135·32	,,	,,
,, trichromate,				13·400	131·49	,,	,,
,, cyanate, .				12·232	120·03	,,	,,
,, cyanide, .				10·050	98·62	,,	,,
,, fluoride, .				14·569	142·96	,,	,,
,, formate, .				7·713	75·69	,,	,,
,, iodide, .				8·726	85·63	,,	,,
,, ,, .			4·84			,,	Quincke
,, molybdate,				15·426	151·37	,,	Traube
,, nitrate, .				11·141	109·32	,,	,,
,, ,, .			8·35			,,	Quincke
,, nitrite, .				11·219	110·09	,,	Traube
,, phosphate (meta), .				14·335	140·56	,,	,,
,, phosphate (pyro), .				17·997	176·60	,,	,,
,, seleno-cyanate, .				3·584	35·17	,,	,,
,, silicate, .				13·089	128·44	,,	,,
,, sulphate, .			17·35			,,	Quincke
,, ,, .			15·92			,,	,,
,, thiocyanate				10·829	106·26	,,	Traube
,, tungstate, .				13·245	129·97	,,	,,
Silver bromide, . .			4			,,	Quincke
,, chloride, . .			8·18			,,	,,
Sodium acetate, . .				4·051	39·75	,,	Traube
,, arsenate, .				19·166	188·07	,,	,,
,, am.-phosphate,			16·79			,,	Quincke
,, borate, . .				18·231	178·89	,,	Traube
,, bromide, .				10·752	105·51	,,	,,
,, ,, .			4·08			,,	Quincke
,, carbonate, .			17·88			,,	,,
,, ,, .			16·24			,,	,,
,, ,, .				21·503	211·00	,,	Traube
,, chlorate, .				9·583	94·03	,,	,,
,, chloride, .				11·842	116·20	,,	,,
,, ,, .			8·41			,,	Quincke
,, chromate, .				19·088	187·30	,,	Traube
,, dichromate, .				15·192	149·07	,,	,,
,, cyanide, .				11·141	109·32	,,	,,
,, formate, .				7·869	77·22	,,	,,
,, molybdate, .				18·075	177·36	,,	,,
,, nitrate, . .				11·842	116·20	,,	,,
,, ,, . .			8·55			,,	Quincke

Substance.	Temperature t° C.	Specific Gravity.	a^2.	α. mgms/mm.	α. dynes/cm.	Method.	Authority.
Sodium nitrite, . .				12·544	123·09	Drops	Traube
,, metaphosphate,				17·763	174·30	,,	,,
,, pyrophosphate,				25·321	248·47	,,	,,
propionate, .				2·259	22·17	,,	,,
,, ,, .				2·462	24·16	,,	,,
,, stearate, .				1·465	14·38	,,	,,
,, sulphate, .				18·854	185·01	,,	,,
,, ,, .			17·64			,,	Quincke
,, tungstate, .				20·178	198·00	,,	Traube
,, ditungstate, .				14·725	144·49	,,	,,
,, valerate, .				1·417	13·90	,,	,,
,, vanadate, .				20·101	197·24	,,	,,
Strontium chloride, .			8·18			,,	Quincke

Quincke suggested that for all substances at or near their solidifying points,—

$$a^2 = n \times 4{\cdot}3\,;$$

and he gives,—

$$n = 1$$

for Se, Br, S, P, NaBr, KBr, AgBr, and KI; experimental results range from

$$3{\cdot}42 \text{ to } 4{\cdot}84:$$

$$n = 2$$

for Hg, Pb, Bi, Sb, $NaNO_3$, KNO_3, LiCl, NaCl, KCl, $CaCl_2$, $SrCl_2$, $BaCl_2$, AgCl, cane sugar, grape sugar, pectin sugar, spermaceti, paraffin, and wax; experimental results range from 7·18 to 9·49;

$$n = 4$$

for Pt, Cd, Sn, Au, Ag, Cu, Li_2CO_3, Na_2CO_3, K_2CO_3, Na_2SO_4, K_2SO_4, microcosmic salt, borax, glass, and water; experimental results range from 14·8 to 17·9;

$$n = 6$$

for Pd, Zn, and cast iron; experimental results range from 25·3 to 27·1:

$n = 12$ for Na; experiment gave 53 instead of 51·6;
$n = 20$ for K; experiment gave 85·7 instead of 86.

Traube's numbers (*Ber.*, xxiv. p. 3074 *et seq.*) have been employed to calculate the values of α on the supposition that for water at 0° C., $\alpha = 7{\cdot}791$, more closely approximate to the results of the drop method than 7·6 given by him.

Siedentopf obtained his results by accurately determining the radius of a flattened drop (T) and the radius of curvature of the drop surface (μ), and calculating by means of the following formula—

$$a^2 = T^3/kx(\mu - T)$$

where $x = T/\mu$, and

$$k(x) \equiv 2{\cdot}124 + 1{\cdot}0178x + \tfrac{1}{8}\sqrt{1 - 16(x - \tfrac{2}{3})^2}.$$

If σ = density of the molten substance,
σ_0 = ,, medium in which the capillary surface is formed,
then,

$$\alpha = a^2(\sigma - \sigma_0)/2.$$

The method is elegant and exceedingly useful, so the experimental data on which he based his calculations are appended.

For mercury at 16° C.—

T	μ
3·994	7·4509
4·047	7·6537
4·1175	7·9002
4·165	8·0943
4·2425	8·4296
4·318	8·7778
4·365	8·9422
4·4015	9·1231

For tin—

	mms.	mm.
at 277° C.	T = 4·807	μ = 6·932
290	4·927	7·231
432	5·018	7·469
513	4·655	6·6586

For bismuth—

at 346° C.	T = 4·0306	μ = 6·664
511	4·0735	6·858

For lead—

at 389° C.	T = 4·0307	μ = 6·3674
498	4·0359	6·4304

For cadmium—

at 365° C.	T = 4·087	μ = 5·1683
431	4·5709	6·1203

For alloy of 80 parts Sn + 20 parts Bi—

at 225° C.	T = 4·261	μ = 5·9437
339	4·424	6·3391

For alloy of 62·5 parts Sn + 37·5 parts Bi—

at 266° C.	T = 4·227	μ = 6·0052
407	4·2342	6·0529

For alloy of 53·1 parts Sn + 46·9 parts Bi—

at 175° C.	T = 4·6782	μ = 7·3240
296	4·2285	6·1853

For alloy of 37 parts Sn + 63 parts Bi—

at 242° C.	T = 4·227	μ = 6·3883
373	4·2124	6·4049

For alloy of 19·7 parts Sn + 80·3 parts Bi—

at 281° C.	T = 4·1821	μ = 6·5820
417	4·2194	6·7493

This investigator gives the following interpolation and extrapolation formulæ :—

For mercury,	$a_\theta = 46\cdot29(1-0\cdot0_3351\tau)$:	$a_\theta^2 = 6\cdot769(1-0\cdot0_3185\tau)$:	$\tau=\theta+39$
" tin,	$62\cdot43(1-0\cdot0_3272\tau)$:	$17\cdot87\ (1-0\cdot0_3164\tau)$:	$\theta-226$
" bismuth,	$43\cdot78(1-0\cdot0_3233\tau)$:	$8\cdot755(1-0\cdot0_3117\tau)$:	$\theta-271$
" lead,	$51\cdot94(1-0\cdot0_3287\tau)$:	$9\cdot778(1-0\cdot0_3166\tau)$:	$\theta-325$
" cadmium,	$84\cdot85(1-0\cdot0_3419\tau)$:	$21\cdot24\ (1-0\cdot0_3255\tau)$:	$\theta-318$
" alloy (1),		$15\cdot9\ (1-0\cdot0_3108\tau)$:	$\theta-195$
" " (2),		$14\cdot6\ (1-0\cdot0_3119\tau)$:	$\theta-140$
" " (3),		$13\cdot4\ (1-0\cdot0_3126\tau)$:	$\theta-140$
" " (4),		$12\cdot25\ (1-0\cdot0_3169\tau)$:	$\theta-140$
" " (5),		$10\cdot6\ (1-0\cdot0_3161\tau)$:	$\theta-225$

θ = temperature on ordinary Centigrade scale.

He also found that if m_1, m_2 respectively denote the percentage of each ingredient in a binary alloy, and if a_1^2, a_2^2 be the specific cohesion of the ingredients separately, then—

$$a_m^2 = \text{specific cohesion of alloy} = \frac{m_2a_1^2 + m_2a_2^2}{m_1+m_2},$$

and with none of the preceding alloys did the calculated value differ as much as 1·5 per cent. from that experimentally determined.

Siedentopf's formulæ for mercury, gave for that liquid at 0° C.,

$$a_0 = 45\cdot656 \text{ mgm./mm.}$$
$$a_0^2 = 6\cdot720$$

If a^2 is calculated from a_0 and the density of mercury at 0° C., we get

$$a_0^2 = 6\cdot716.$$

TABLE LXXIJ.—Surface Tension, etc., of Liquefied Gases.

In his researches on liquid air Kipp found that it loses nitrogen readily, so that with age its physical properties approximate more and more closely to those of liquid oxygen. The following are the mean values of the experimental results obtained with liquid air of the age stated :—

Age in minutes.	Density.	a in dynes/cm.
75	1	10·24
140	1·05	10·36
260	1·1	11·28
450	1·131	13·35

Other series gave—

Age in minutes.	Density.	a in dynes/cm.	Age in minutes.	Density.	a in dynes/cm.
(A) 115	1·026	10·78	150	1·047	11·98
135	1·038	11·91	160	1·053	12·07
145	1·045	12·38	(C) 67	0·995	11·07
240	1·09	12·59	112	1·024	11·28
265	1·099	12·45	182	1·065	12·00
280	1·104	12·79	222	1·083	12·53
295	1·108	12·91	257	1·095	12·96
320	1·116	13·05	274	1·103	13·01
352	1·124	13·14	294	1·108	13·12
370	1·1245	13·17	312	1·114	13·24
385	1·127	13·23	324	1·118	13·30
410	1·13	13·18	340	1·122	13·31
(B) 133	1·037	11·42			

Grunmach gives the following values for liquid air, or rather the liquid residue left at about $-190°$ C.

Percentage of liquid oxygen in mixture,	49·9	63·9	65·3	66·8	67·6	74·4	76·4	76·7
Values of a in dynes/cm.,	11·61	11·89	12·05	11·90	11·91	12·23	12·51	12·63

This investigator also gives what he calls the corresponding values of a^2, but some curious error must have crept into his calculations, as his numbers involve a *decrease* in density with an *increase* in the percentage of oxygen.

Forsch found the surface tension of liquid air—out of which a great deal of the nitrogen had already evaporated—to be about 1·23 mgm./mm. or 12·08 dynes/cm., corresponding almost exactly to the value found by Grunmach for the liquid containing 65·3 per cent. of oxygen.

Grunmach gives also the following values for a:—

SO_2	at $-25°$ C.	($\sigma_t = 1·5016$)	a in dynes/cm.,	33·285
NH_3	,, -29	(0·6703)		41·778
Cl_2	,, -72	(1·6452)		33·6493
Pictet's liquid $64\%\ SO_2 + 44\%\ CO_2$	,, -33			35·065
	,, -60	(1·564)		38·209 (15 years old)

TABLE LXXIk.—Surface Tension and the Media in contact with the Liquid.

Lord Kelvin, the first to apply the principles of thermodynamics to the phenomena of capillarity and surface tension, proved that when a liquid is in contact with no gaseous medium other than its own vapour

$$p = P \pm \frac{a\rho}{\sigma - \rho}\left(\frac{1}{r} + \frac{1}{r_1}\right) \quad . \quad . \quad . \quad . \quad (1)$$

where p = pressure of vapour at a point in the curved surface formed within a capillary tube dipping in the liquid;
P = pressure of vapour over horizontal surface of liquid;
a = surface tension of liquid;
σ = density of the liquid;
ρ = density of the vapour;
r and r_1 = principal radii of curvature at the point where the vapour pressure is p.

Where the tube is very fine, the meniscus becomes practically a portion of the surface of a small sphere, and $r = r_1$, so—

$$p = P \pm \frac{a\rho}{\sigma - \rho} \cdot \frac{2}{r} = P \pm \frac{2a}{r} \cdot \frac{\rho}{\sigma - \rho} \quad . \quad . \quad . \quad (2)$$

If h = height to which the liquid would be raised or depressed within the tube in virtue of the curvature of its surface,

and $\mathfrak{h}$ = height of homogeneous atmosphere of vapour capable of exerting the pressure P,

$$p = P\,(1 - h/\mathfrak{h}) \quad . \quad . \quad . \quad . \quad (3)$$

Equation (2) may be written—

$$p = P \pm \frac{2a}{r\sigma} \cdot \frac{\rho}{1 - \rho/\sigma} = P \pm h\rho$$

very nearly; or if the pressures are expressed in absolute units,

$$p = P \pm gh\rho \quad . \quad . \quad . \quad . \quad (4)$$

When ρ is insignificant compared with σ we have $\log\,(p/P) = -\,(2a/r)(1/RT)$; where RT has the same significance as in the case of the gas equation, $pv = RT$, *i.e.* the pressure on the vapour side of the meniscus will be $P \pm gh\rho$, and the pressure on the liquid side of the meniscus must be $P \pm gh\sigma$. The difference between these two pressures, *i.e.*,

$$gh(\ \ - \rho) = 2a/r \quad . \quad . \quad . \quad . \quad (5)$$

so

$$a = ghr\,(\sigma - \rho)/2 \quad . \quad . \quad . \quad . \quad (6)$$

This equation holds for all media, and not merely for the vapour of the liquid itself. In general ρ is so small compared with σ that it may be neglected, and if $r = 1$, h becomes a^2 and we get as before;—

$$a = ga^2\sigma/2,$$

or in gravitation units

$$a = a^2\sigma/2$$

Stöckle (curvature of drop method) found that the surface tension of pure mercury varied considerably in different media, but the tension rapidly diminished owing to the condensation of the gas on the surface of the liquid. The following are his results :—

Medium.	Pressure.	Temperature.	Values of a in mgm./mm.	
			On Projection.	An hour afterwards.
Vacuum, . . .	$0{\cdot}0_34$ to 0·001 mm.	15° C.	44·4	44·4
Hydrogen, . . .	Atmospheric pressure	21	47·9	44·2
H_2 and dry air, . .	,,	,,	48·4	44·7
Dry air, . . .	,,	17	48·5	43·7
Dry air free from CO_2,	,,	,,	48·8	44·5
,, ,,	30 mm.	,,	48·4	44·5
Moist air, . . .	Atmospheric pressure	,,	49·4	43·7
Carbon dioxide, . .	,,	19	49·0	44·4
Oxygen, . . .	,,	23	48·7	44·0
,, . . .	30 mm.	,,	48·4	44·0
Nitrogen, . . .	Atmospheric pressure	16	49·8	44·6
,, . . .	10 mm.	,,	49·9	44·6

The diminution in the value of the surface tension takes place very rapidly in hydrogen, but slowly in the comparatively inert nitrogen.

G. Meyer sought to eliminate the effect of gaseous condensation by measuring the waves on a jet of mercury projected into various gases. He obtained the following values for α:—

In air, ...	51·5 mgm./mm.
,, oxygen, ...	51·4
,, nitrogen, ...	50·5
,, carbon dioxide, . . .	49·6
,, hydrogen, ...	56·5

These are much higher than Stöckle's initial values, the reason being that Meyer's measurements were made with an absolutely clean surface of mercury, while in the other case a short time must elapse before any measurement could be made, and a certain amount of surface contamination must have occurred.

P. Volkmann, experimenting in moist air, under a pressure of 750 millimetres of ice-cold mercury, obtained the following results with pure water at various temperatures:—

$t°$ C.	$\sigma-\rho$.	Values of α. Mgms./mm.	Values of α. Dynes/cm.	Value of α^2.
0°	0·99860	7·683	75·40	15·388
2·5	872	653	75·11	326
5	874	623	74·82	265
6	873	602	74·61	223
7·5	867	580	74·39	180
10	850	543	74·03	109
12·5	826	506	73·67	038
15	793	469	73·30	14·969
17·5	753	432	72·94	901
20	706	395	72·57	834
22·5	652	356	72·20	764
25	592	317	71·81	694
30	454	236	71·02	551
35	30	15	70·2	40
40	13	08	69·5	29
For anilin he gets—				
12°·5	1·0272	4·55	44·7	8·87
17 ·5	1·0228	4·49	44·1	8·78
For benzol—				
12°·5	0·88701	3·044	29·86	6·864
17 ·5	88173	2·971	29·16	6·739
And for toluol—				
12°·5	0·86964	2·962	29·07	6·813
17 ·5	86512	2·906	28·52	6·719

For most liquids σ and ρ differ so widely, at anything like ordinary temperature and under ordinary atmospheric pressure, that ρ may be left out of our calculations without

causing any appreciable error; but under increased pressures and at increased temperatures, more especially when approximating to the "critical state," it must be taken into account. A. van Edlip determined the height (H) to which a mixture of ethylene (critical temperature about 10° C. and critical pressure about 51 atmospheres) and methyl chloride (critical temperature about 142° C. and critical pressure about 73 atmospheres) would, under various conditions, ascend in a tube whose radius was 0·1 mm.

t° C.	Pressure in Atmospheres.	H.	t° C.	Pressure in Atmospheres.	H.
10°·4	3·60	39·33	23°·00	5·25	36·00
10 ·2	15·30	30·13	23 ·14	20·62	25·16
10 ·4	19·54	29·96	23 ·08	26·45	23·20
10 ·6	23·61	23·50	23 ·15	30·64	18·50
10 ·3	29·50	19·64	23 ·05	35·20	15·53
10 ·2	32·17	17·74	23 ·15	40·71	12·40
10 ·3	37·92	14·24	23 ·07	41·56	11·79
10 ·2	39·65	13·49	23 ·00	43·26	10·92
10 ·4	44·05	10·55	23 ·02	45·85	9·71
10 ·3	46·28	8·67	23 ·07	50·74	7·39
10 ·4	49·10	6·55	23 ·07	52·84	6·20
10 ·2	52·04	3·63	23 ·00	54·11	4·92
10 ·3	55·20		23 ·00	59·15 ± 0·09	

TABLE LXXII.—Relations between Surface Tension and various other Physical Properties.

Röntgen and Schneider investigated the relations between surface tension and compressibility, and they gave the following values for the "relative compressibility" of the various solutions whose surface tensions have already been given on page 759.

Substance in Solution.	Relative Compressibility.		Substance in Solution.	Relative Compressibility.	
	0·7 Normal.	1·5 Normal.		0·7 Normal.	1·5 Normal.
Hydrogen nitrate, .	0·990	0·980	Lithium sulphate, .	827	682
,, bromide, .	986	972	Sodium iodide, . .	939	892
,, chloride, .	976	954	,, nitrate, . .	934	878
Water, . . .	1·000	1·000	,, bromide, .	932	870
Hydrogen sulphate, .	0·984	0·942	,, chloride, .	922	849
Ammonium iodide, .	979	960	,, hydroxide, .	875	761
,, nitrate, .	976	953	,, sulphate, .	817	
,, bromide, .	973	951	,, carbonate, .	801	644
,, chloride, .	961	933	Potassium iodide, .	954	913
,, hydroxide,	1·010	1·009	,, nitrate, .	948	901
,, sulphate, . .	0·887	0·808	,, bromide, .	947	894
Lithium iodide, . .	955	918	,, chloride, .	931	872
,, nitrate, .	945	893	,, hydroxide, .	884	779
,, bromide, .	943	887	,, sulphate, .	828	
,, chloride, .	933	868	,, carbonate, .	813	669
,, hydroxide, .	888	782			

cy give the empirical equation—

$$K^2 = V_0(1 + \alpha t)/v\beta,$$

K denotes Laplace's constant;
β ,, the compressibility;
V_0 ,, the volume at $t°$ C. under 1 atmosphere pressure of 1 kgm. of the vapour of the liquid concerned;
v ,, the volume of 1 kgm. of the liquid or solution at $t°$ C.

TABLE LXXIM.

The following table gives the actual experimental results obtained by those investi-rs, as far as density, compressibility, etc., are concerned; unfortunately they have not n us the results referring to surface tension.

= molecular weight of the dissolved substance;
= percentage of substance in the solution;
= number (relative) of molecules of substance to 1 grm. of water $= \frac{1,000,000}{m} \cdot \frac{p}{100-p}$;
= density of solution at $t°$ C.
= relative compressibility detemined at $t°_1$ C.

Substance dissolved.	m.	p.	n.	d.	$t°$ C.	c.	$t°_1$ C.
Hydrogen nitrate,	62·89	8·84	1542	1·0458	17°·9	0·958	17°·92
		4·21	697	0212	17 ·9	981	94
,, bromide,	80·76	10·77	1495	0781	18 ·0	960	72
		5·23	684	0368	18 ·0	981	81
,, chloride,	36·37	5·24	1520	0244	18 ·0	918	98
		2·51	707	0111	17 ·9	974	50
Water,	17·96			0·9987	18 ·0	1·000	18 ·00
Hydrogen sulphate,	97·82	12·70	1487	1·0857	18 ·1	0·921	17 ·98
		6·57	719	0420	18 ·0	969	72
Ammonium iodide,	144·55	17·77	1495	1285	18 ·0	910	59
		9·14	696	0620	18 ·0	954	61
,, nitrate,	79·90	12·60	1804	0529	18 ·0	893	94
		10·87	1526	0452	18 ·0	906	18 ·30
		6·23	834	0255	18 ·0	945	17 ·68
		5·26	695	0211	18 ·0	954	75
,, bromide,	97·77	12·81	1503	0745	18 ·0	910	91
		6·41	701	0357	18 ·0	953	94

TABLE LXXIm.—*continued.*

Substance.	$m.$	$p.$	$n.$	$d.$	$t°$ C.	$c.$	$t_1°$ C.
Ammonium chloride, . .	53·38	7·23	1459	1·0210	17°·9	0·903	17°·91
		3·51	682	0096	18 ·0	946	79
,, hydroxide, .	34·97	4·66	1400	0·9889	18 ·0	974	64
		2·30	672	9938	18 ·0	992	91
,, sulphate, . .	131·84	16·22	1562	1·0968	18 ·0	732	78
		8·74	726	0495	18 ·0	849	81
Lithium iodide, . . .	133·55	16·63	1494	1380	18 ·0	888	88
		8·49	695	0656	18 ·0	940	88
,, nitrate, . . .	68·90	9·29	1486	0554	18 ·0	871	82
		4·35	694	0264	18 ·0	935	81
,, bromide, . .	86·77	11·78	1539	0895	18 ·0	866	64
		5·84	715	0422	18 ·0	933	71
,, chloride, . .	42·38	6·07	1524	0339	18 ·0	856	88
		2·93	712	0160	18 ·0	927	90
,, hydroxide. . .	23·97	3·39	1464	0380	18 ·0	798	82
		1·61	684	0178	18 ·0	897	18°·04
,, sulphate, . .	109·86	14·16	1502	1249	18 ·1	655	18 ·16
		7·14	700	0601	18 ·1	813	17 ·78
Sodium iodide, . . .	149·54	18·75	1542	1647	18 ·1	859	17 ·99
		9·51	703	0781	18 ·1	924	18 ·00
,, nitrate, . . .	84·89	11·41	1517	0791	17 ·9	851	17 ·87
		10·38	1364			868	52
		5·70	719	0383	18 ·1	920	79
,, bromide,. . .	102·76	13·44	1511	1119	18 ·0	850	69
		6·87	718	0541	18 ·1	921	82
,, chloride, . . .	58·37	8·27	1544	0585	18 ·0	833	95
		4·05	724	0278	18 ·1	914	18 ·13
,, hydroxide, . .	39·96	5·70	1513	0634	18 ·1	768	17 ·68
		2·74	705	0298	18 ·0	880	17 ·78
,, sulphate, . . .	141·82	10·22	706	0829	18 ·0	802	18 ·35
,, carbonate, . .	105·85	13·78	1510	1460	17 ·9	629	17 ·59
		6·94	704	0716	18 ·0	796	99
Potassium iodide, . .	165·57	19·70	1482	1646	18 0	871	85
		10·27	691	0794	18 ·1	933	66
,, nitrate, . .	100·92	12·84	1480	0836	18 ·0	865	76
		6·45	684	0405	18 ·1	932	18 ·00
,, bromide, . .	118·79	14·90	1474	1156	18 ·0	864	03
		13·93	1362	1041	18 ·0	872	13
		7·68	700	0545	18 ·0	930	05
,, chloride, . .	74·40	9·90	1479	0636	18 ·1	850	09
		4·88	690	0300	18 ·0	920	17 ·92
,, hydroxide, . .	55·99	7·72	1475	0697	18 ·0	780	81
		3·71	688	0330	18 ·0	886	74
,, sulphate, . .	173·88	9·30	589	0764	18 ·0	834	61
,, carbonate, .	137·91	16·94	1479	1577	18 ·0	642	81
		8·69	690	0778	18 ·0	801	18 ·03

TABLE LXXIn.

With the hydrocarbons C_nH_{2n+2} Bartoli found that

$$a^2/c\sigma$$

is very nearly constant, when c = specific heat of the liquid substance.

Formula.	$t°$ C.	a^2_t.	σ_t.	c.	Range of c.	$a^2/c\sigma$.
C_6H_{14}	11°	5·938	0·6863	0·5042	16° C. to 37° C.	17·160
C_7H_{16}	12	6·640	7296	4841	17 „ 50	18·980
C_7H_{16}	12	6·627	7202	4869	18 „ 51	18·900
C_8H_{18}	11	6·717	7375	5111	12 „ 19	17·820
C_9H_{20}	14	6·757	7513	5015	13 „ 18	17·930
$C_{10}H_{22}$	13	6·904	7617	5058	14 „ 18	17·920
$C_{11}H_{24}$	14	6·965	7718	5032	14 „ 19	17·930
$C_{12}H_{26}$	13	7·106	7826	5065	14 „ 20	17·930
$C_{13}H_{28}$	14	7·190	7922	4987	15 „ 21	18·200
$C_{14}H_{30}$	13	7·252	8040	4995	14 „ 21	18·060
$C_{15}H_{32}$	13·3	7·366	8137	4991	15 „ 21	18·135
$C_{16}H_{34}$	14	7·416	8200	4964	15 „ 22	18·220

TABLE LXXIo.—**Surface Tension, Critical Temperature, Molecular Dimensions, etc.**

Eotvös has shown that for many liquids $d(av^{\frac{2}{3}})/dt$ is a magnitude independent both of the nature of the liquid and of the temperature, v denoting the "molecular volume" of the liquid, *i.e.* the molecular weight divided by the density; or "the rate of variation with the temperature of the product of the surface tension of a liquid by its molecular domain raised to the power $\frac{2}{3}$ is the same for all liquids." From this it follows that if θ denote the temperature at which a, and consequent $av^{\frac{2}{3}}$, $=0$, then,—

$$av^{\frac{2}{3}} = k(\theta - t).$$

Ramsay puts this equation in a slightly different form—

$$av^{\frac{2}{3}} = k(\vartheta - d - t) = k(\tau - d),$$

where ϑ is the critical temperature, d a constant, and $\tau = \vartheta - t$, or the temperature reckoned downwards from the critical temperature. When pretty close to the critical temperature the equation given by Rose-Innes—

$$av^{\frac{2}{3}} = k(\tau - d) + kd/10^{\lambda\tau}$$

(where λ = a constant not differing widely from 0·03), yields results more in accordance with experimental ones.

Eotvös found

$$d(av^{\frac{2}{3}})/dt = -k = -0{\cdot}227, \text{ when } a \text{ is given in mgms./mm.}$$
$$= -2{\cdot}227 \text{ when } a \text{ is given in dynes/cm.}$$

Therefore—

$$av^{\frac{2}{3}} = 2{\cdot}227(\theta - t) = 2{\cdot}227(\vartheta - d - t) = 2{\cdot}227(\tau - d).$$

As $v = M/\sigma$, this last equation gives us—

$$M = \sigma\sqrt{\left(\frac{2{\cdot}227(\theta - t)}{a}\right)^3} = \sigma\sqrt{\left(\frac{2{\cdot}227(\tau - d)}{a}\right)^3},$$

giving us a method for determining the molecular weight of a liquid body from its surface tension. For this purpose we need not determine θ, τ or d experimentally; determinations of a at two or three temperatures will supply us with all the data we require for our calculations.

If we knew the true values of M and σ, the value of k as calculated from them should be the same under all conditions; but σ we know varies with the temperature, and so also does M, as unquestionably the degree of "association" varies somewhat with the temperature. Eotvös found that for liquid water between 100° C. and 200° C., M worked out as 36; *i.e.* the molecular formula of liquid water between 100° C. and 200° C. is H_4O_2; below 100° C. it is still more complicated, the mean value of molecular weight of liquid water at 85° C. being 50; at 65° C., 53·3 ($\equiv H_6O_3$ very nearly); at 45° C., 56; at 25° C., 62; and at 5° C., 69 very nearly (approximately H_8O_4).

Grunmach, using the value 2·27 for k, found the following molecular weights for liquefied gases:—

Sulphur dioxide = 65·66 ($\equiv SO_2$ practically).
Ammonia = 17·10 ($\equiv NH_3$,,).
Chlorine = 92·14 ($7xCl_2 + 3xCl_4$ very nearly).

Ramsay and his colleagues took 2·1209 as a fair average value for k. If we put $\mathrm{M} = \mathfrak{M}x$, M representing the mean value of the weight of a liquid molecule, $\mathfrak{M}$ the molecular weight of the homogeneous vapour, x = the association factor, and k = experimental value, for any liquid;—

$$2{\cdot}1209/k = x^{\frac{2}{3}}.$$

Values of ϑ, k, d, x, and M. (Ramsay, etc.)

Liquid.	ϑ	k.	d.	x.	M.
Ethyl oxide, ...	194°·5 C.	2·1716	8°·5		
Methyl formate, . .	214	2·0419	5 ·9		
,, acetate, . .	233 ·7	2·109	4 ·5		
,, propionate, . .	257 ·4	2·182	5 ·3		
,, butyrate, . .	281 ·25	2·220	3 ·75		
,, isobutyrate, . .	267 ·55	2·248	5 ·25		
Ethyl formate, . . .	235 ·4	2·020	4 ·5		
,, acetate, ...	251	2·2256	6 ·7		
,, propionate, . .	272 ·9	3·240	4 ·9		
Propyl formate, . .	264 ·85	2·110	4 ·85		
,, acetate, . .	276 ·2	2·227	5 ·0		
Carbon tetrachloride, .	283	2·1052	6 ·0		
Benzol, ...	288 ·5	2·1043	6 ·3		
Chlorbenzol, . . .	360	2·0770	6 ·5		
Acetic acid, ...	321 ·5	at 20° 0·8815		3·73	223·9
,, ...	321 ·5	,, 100 1·058		2·84	170·3
,, ...	321 ·5	,, 150 1·198		2·36	140·3
Methyl alcohol, . .	240	,, − 89°·8 0·868		3·82	122·2
,, ...	240	,, 20 0·932		3·43	109·8
,, ...	240	,, 150 1·236		2·25	72·0
Ethyl alcohol, . . .	243 ·1	,, − 89 ·8 0·949		3·34	153·6
,, ...	243 ·1	,, 20 1·070		2·79	128·3
,, ...	243 ·1	,, 150 1·569		1·57	72·2

Eotvös had found the following values for k (α being expressed in mgms./mm.):—

Ethyl ether,	6° C. to	62° C.	0·228	Sulphur dioxide,	2° C. to	60° C.	0·230
"	62	120	0·226	Carbon dioxide,	3	31	0·228
"	120	190	0·221	Ethyl alcohol,	21	78	0·104
Ethylene bromide,	20	99	0·227	"	78	108	0·136
"	99	213	0·232	"	108	138	0·159
Chloroform,	20	60	0·230	"	138	168	0·183
Mercury methide,	20	99	0·228	"	168	199	0·202
Carbon-oxychloride,	3	63	0·231	"	199	236	0·226
Carbon disulphide,	22	78	0·237				

For acetic acid, if we put its molecular formula $C_2H_4O_2$, k works out as ·132 between 21° and 160° C. and only ·138 between 160° and 230° C.; but if we take it as $C_4H_8O_4$, then $k=0·211$.

There is something strange about the numbers for the first substance in the preceding table. They ought to have increased with rise of temperature; they diminish instead.

From the results obtained with acetic acid, methyl alcohol and ethyl alcohol, it looks as if the superior limit of x, at least for the liquids mentioned, is 4: that is,—

M is never greater than $4\mathfrak{M}$.

TABLE LXXIP.

As already stated, the Rose-Innes equation answers better at temperatures approaching ϑ; the following results given by Ramsay and Shields emphatically show this. The values of k and d have been already given.

Ethyl Oxide. $\lambda=0·03$.				Benzol. $\lambda=0·029$.			
τ	$kd/10^{\lambda\tau}$	$av^{\frac{2}{3}}$. Calculated.	$av^{\frac{2}{3}}$. Found.	τ	$kd/10^{\lambda\tau}$	$av^{\frac{2}{3}}$. Calculated.	$av^{\frac{2}{3}}$. Found.
0	18·45	0	0	0	13·7	0	0
4 5	13·6	4·9	5·5	8·5	7·7	11·9	9·0
9·5	9·6	11·8	12·3	13·5	5·5	20·3	19·9
14·5	6·8	19·8	19·9	18·5	4·0	29·3	28·8
24·5	3·4	38·2	39·0	28·5	2·0	48·3	48·6
34·5	1·7	58·2	58·6	38·5	1·0	68·3	68·7
44·5	0·9	79·1	78·7	48·5	0·5	88·9	89·0
54 5	0·4	100·3	100·4	58·5	0·3	109·7	110·1
64·5	0·2	121·8	122·0	68·5	0·1	130:6	131·0
74·5	0·1	143·4	143·6	78·5	0·1	151·6	151·9
84·5	0·05	165·1	165·3				

Methyl Formate. $\lambda=0{\cdot}044$.				Ethyl Acetate. $\lambda=0{\cdot}0312$.			
τ	$kd/10^{\lambda\tau}$	$av^{\frac{2}{3}}$. Calculated.	$av^{\frac{2}{3}}$. Found.	τ	$kd/10^{\lambda\tau}$	$av^{\frac{2}{3}}$. Calculated.	$av^{\frac{2}{3}}$. Found.
0	14·9	0	0	0	12·1	0	0
6	9·7	8·1	7·2	4	8·1	4·2	4·0
11	6·8	16·4	15·9	14	2·9	19·4	19·2
21	3·3	35·1	55·7	24	1·1	38·1	37·7
31	1·6	55·7	56·8	34	0·4	57·8	57·3
41	0·8	77·1	78·4	44	0·1	77·9	76·9
51	0·4	99·0	98·9				
61	0·2	121·0	120·4				
71	0·1	143·2	143·0				

The simpler formula $av^{\frac{2}{3}}=k(\tau-d)$ gives numbers that do not nearly agree with the experimental results when τ is less then 44·5 for methyl oxide, 14 for methyl formate, 38·5 for benzol, or 41 for ethyl acetate: thus with the first substance if $\tau=14{\cdot}5$ we get, according to the formula, $av^{\frac{2}{3}}=13$ instead of 19·9 as given by experiment, while $av^{\frac{2}{3}}$ is according to the formula $-8{\cdot}7$ when τ is 4·5.

As $v^{\frac{1}{3}}$ is proportional to the mean linear distance between the molecules, $nv^{\frac{2}{3}}$ will represent an area containing n molecules, or rather on which n molecules lie, and if p represent the vapour pressure on a unit area,

$$pnv^{\frac{2}{3}}$$

will represent the total vapour pressure on such a surface.

Further, $mv^{\frac{1}{3}}$ represents a line on which lie m molecules, and the total surface tension across a line will be $amv^{\frac{1}{3}}$. Eotvös assumes that for any two liquids—

$$a_1/p_1v_1^{\frac{1}{3}}=a_2/p_2v_2^{\frac{1}{3}};$$

or

$$a_1v_1^{\frac{2}{3}}/p_1v_1=a_2v_1^{\frac{2}{3}}/p_2v_2.$$

According to van der Waals, when two substances are in the "corresponding states,"

$$V_1/V_2=v_1/v_2=p_2T_1/p_1T_2$$

(V denoting the molecular volume of a substance in the state of vapour $=\mathfrak{M}/\rho$). Under such conditions therefore we get

$$a_1v^{\frac{2}{3}}/T_1=a_2v_2^{\frac{2}{3}}/T_2$$

This, like most equations relating to "corresponding states," gives good results when compounds of analogous chemical structure are compared, but breaks down pretty thoroughly if we attempt to apply it to substances belonging to totally different chemical classes; *e.g.* benzol and alcohol, or benzol and ether.

This quantity $av^{\frac{2}{3}}$ many be termed "molecular superficial energy": its temperature coefficient k, according to Dutoit and Friederich, does not vary with the temperature in "normal" liquids but does so in "abnormal" ones. They give the following values for k:—

Metaxylol,	2·10	Paratoluidin,	1·72
Mesitylene,	2·15	Dimethyl-o.-toluidin,	2·49
Durol,	2·14	Diphenyl-amine,	2·57
Pentamethyl benzol,	2·165	Pyridin,	2·17
Hexane,	2·11	Quinolin,	2·43
Diphenyl,	2·22	Acetonitril, 16° to 90° C.,	1·50 to 1·56
Naphthalin,	2·29	Propoionitril, 13° to 76°,	1·67 to 1·74
Diphenylmethane,	2·23	Butyronitril, 17° to 96°,	1·89
Anilin,	1·60 to 2·05	Paratoluol, 57° to 180°,	1·88 to 2·05
Methylanilin,	1·99 to 2·08	Diphenyl-ethane (sym.),	2·49
Ethylanilin,	2·22	Acetone,	1·83
Dimethylanilin,	2·39	Methyl-ethyl-ketone,	1·85
Diethylanilin,	2·34	Acetophenone,	2·14
Orthotoluidin,	2·05	Benzophenone,	2·63

Verschaffelt finds that for—

Liquid CO_2 between $-24°·3$ and $+8°·9$ C., $k = 2·223$;
" " " $+8°·9$ " $15°·2$ C., " $= 2·222$;
" N_2O " $-24°$ " $+14°·4$ C., " $= 2·198$.

Eotvös's original idea seems to have been that as with normal gases, at temperatures equally removed from the absolute zero, the product of the pressure by the molecular volume is the same for all gases, so for all normal liquids, at temperatures equally removed from their critical points, the product of the surface energy by the molecular area is the same for all liquids. As shown by Ramsay and his fellow-workers, this can at best be looked upon as a very rough approximation to the truth, and even the final value of k adopted by these investigators is far too low. For liquids where "association" is entirely absent, k should be of the maximum value, and, unless we suppose that some liquids contain a fair proportion of associated molecules, we must set this value nearer to 2·500 than 2·121. Guye and Baud investigated this question in connection with some twelve substances, and the results of their investigations are given. The last two columns in the following table give the values of k and x as calculated by the compiler from the data obtained by these Genevan investigators; their methods of computation seemed in some respects undesirable.

TABLE LXXIq.—**Values of** a, k, x, **etc.** (Guye and Baud.)

Substance.	$t°$ C.	σ_t.	a_t.	$a_t v^{\frac{2}{3}}$.	k.	x.	k. (k taken = 2·4.)	x. (k taken = 2·4.)
			Dynes/cm.					
Phenetol,	19°·2 C.	0·9672	32·60	819·91			2·362	1·02
$C_6H_5.OC_2H_5$,	63 ·6	9249	27·25	706·1	2·563	0·75	2·332	1·04
$\mathfrak{M} = 122$,	108 ·7	8818	22·00	607·2	2·376	0·84	2·357	1·03
	152 ·4	8380	18·22	504·22	2·370	0·94	2·357	1·03
Anisol,	9	1·0022	35·48	803·45			2·142	1·19
$C_6H_5.OCH_3$,	54 ·6	0·9610	30·36	695·90	2·358	0·85	2·112	1·21
$\mathfrak{M} = 108$,	98 ·8	9178	24·8	595·5	2·315	0·87	2·088	1·23
	152 ·9	8622	19·28	482·56	2·229	0·92	2·088	1·23

TABLE LXXIq.—*continued.*

Substance.	$t°$ C.	σ_t.	a_t.	$a_t v^{\frac{2}{3}}$.	k.	x	k. (k taken = 2·4.)	x
			Dynes/cm.					
Ethyl acetate, . .	9°·5	0·9137	24·71	519·16			1·944	1·37
$CH_3COOC_2H_5$, . .	55 ·6	8566	18·82	413	2·302	0·88	1·869	1·46
$\mathfrak{M} = 88$, . . .	77	8286	16·63	373	2·165	0·96	1·869	1·46
Nitrobenzol, . .	9 ·4	1·209	43·8	954·5			2·084	1·24
$C_6H_5NO_2$, . .	55 ·5	1680	38·41	856·54	2·124	0·99	2·079	1·24
$\mathfrak{M} = 123$, . . .	99 ·8	1240	33·26	760·9	2·165	0·96	2·070	1·25
	153	0625	27·4	650·8	2·114	1·01	2 070	1·25
Metacresol, . .	9	0702	38·78	840·6			1·877	1·45
$OHC_6H_4.CH_3$, . .	55 ·4	0052	32·98	745·3	2·053	1·05	1·857	1·47
$\mathfrak{M} = 108$, . . .	98 ·7	0·9695	29·29	678·1	1·811	1·26	1·893	1·43
	153 ·1	0·9217	24·02	575·1	1·842	1·23	1·893	1·43
Benzonitril, . .	8	1·0157	39·61	861·4			2·105	1·22
$C_6H_5.CN$, . . .	54 ·9	0·9726	33·82	757·0	2·226	0·93	2·089	1·23
$\mathfrak{M} = 103$, . . .	99 ·1	9388	29·30	673·9	2·068	1·04	2·118	1·21
	152 ·4	8848	23·53	561·0	2·080	1·02	2·118	1·21
Valeroxime, . .	16 ·2	8958	27·28	636·66			1·659	1·80
$C_4H_9.CH : N.OH$, .	55 ·4	8608	23·58	565·12	1·825	1·25	1·741	1·62
$\mathfrak{M} = 101$, . . .	106 ·4	8144	19·40	482·44	1·709	1·39	1·763	1·59
	152 ·2	7715	15·58	401·70	1·727	1·35	1·763	1·59
Methylethyl-ketoxime,								
$\begin{matrix} CH_3 \\ C_2H_5 \end{matrix} > C : N.OH$, .	13 ·8	9263	29·30	605·40			1·747	1·61
$\mathfrak{M} = 87$, . . .	150 ·4	7963	16·05	366·81	1·746	1·33	1·747	1·61
Phenylurethane, .	63 ·8	1·0780	34·17	857·09			2·152	1·18
$C_6H_5OCONH_2$, . .	108 ·8	1·0388	30·68	794·90	1·382	1·90	2·25	1·10
$\mathfrak{M} = 137$, . . .	152 ·8	0·9990	26·17	695·9	1·810	1·26	2·25	
Methylurethane, .	55 ·9	1·1358	37·49	612·47			1·552	1·92
CH_3OCONH_2, . .	101 ·2	1·0872	32·2	541·6	1·564	1·57	1·550	1·93
$\mathfrak{M} = 75$, . . .	150 ·9	1·0334	26·70	464·55	1·557	1·58	1·550	
Ethylurethane, . .	65 ·1	1·0395	30·26	587·81			1·564	1·90
$C_2H_5OCONH_2$, . .	107 ·6	1·0006	26·30	524·06	1·500	1·68	1·572	1·89
$\mathfrak{M} = 89$, . . .	152 ·6	0·9509	22·00	453·30	1·537	1·62	1·572	
Isopropylurethane, .	65 ·5	9951	27·67	610·00			1·479	2·07
$C_3H_7OCONH_2$, . .	107 ·3	9552	24·18	547·80	1·488	1·701	1·478	2·07
$\mathfrak{M} = 103$, . . .	152 ·4	9097	20·56	481·16	1·494	1·691	1·478	

As the degree of association is in most cases an indirect function of the temperature, an approximation has been made to the value of ϑ ($\equiv$temperature when $a = 0$) from the results obtained at the highest temperatures. From this value of ϑ the values of k for the various temperatures have been calculated by means of the equation

$$av^{\frac{2}{3}} = k(\vartheta - t).$$

These results are given in the eighth column. The values given in column six were obtained for each interval of temperature by the formula—

$$k = \frac{a_1 v_1^{\frac{2}{3}} - a_2 v_2^{\frac{2}{3}}}{t_2 - t_1}.$$

The values of x given in the seventh column have been computed by means of the formula

$$\text{Log } x = \frac{3}{2} (\log 2{\cdot}121 - \log k);$$

those in the ninth column from

$$\text{Log } x = \frac{3}{2} (\log 2{\cdot}4 - \log k).$$

Anisol and phenetol evidently belong to the class of substances whose "association" tends to increase with a rise of temperature, at least up to a certain point.

Dutoit and Friederich give, as a fairly general approximation,

$$\pi = Q\alpha \,/\, \sqrt[3]{\phi},$$

where π = critical pressure, ϕ = critical molecular volume, and Q = a constant: for many substances Q is not found to be far from 11·1.

For liquefied gases, etc., Verschaffelt finds:—

$$a = A\,(1 - m)^{B}$$

where m = "reduced temperature," *i.e.* $t^{\circ}/\vartheta^{\circ}$ and A and B are constants. Various values have been assigned to B; van der Waals puts it = 3/2; Ramsay and Shields find B = 1·23 and Verschaffelt finds B = 1·521. The following values are given:—

Substance.	Log A.	Value of B.
Carbon dioxide,	1·924	1·311
Nitrous oxide,	1·945	1·33
Carbon tetrachloride,	1·811	1·228
Ethyl oxide,	1·761	1 270
Ethyl acetate,	1·810	1·230
Benzol,	1·839	1·230
Chlorbenzol,	1·827	1·214

De Heen gives the following equation,—

$$r = 0{\cdot}0_7215\,a\mathrm{M}/\sigma,$$

where r denotes the radius of the "sphere of influence" of the liquid molecule; and he calculated the values of r for the following six substances:—

Water,	r =	297×10^{-9} cm.
Sulphuric acid,		718 ,, ,,
Platinum @ 2000° C.,		3727 ,, ,,
Silver @ 1000° C.,		991 ,, ,,
Lead @ 330° C.,		1838 ,, ,,
Mercury,		1740 ,, ,,

Kistiakowsky gives the following expression for the molecular weight of a liquid,—

$$\mathrm{M} = (2{\cdot}3\vartheta/ghr\sigma^{\frac{1}{2}})^{\frac{3}{2}},$$

where

ϑ = Absolute boiling point;
h = Height to which liquid ascends in tube of radius r;
g = Acceleration due to gravitation;
σ = Density of liquid.

TABLE LXXIR.—Surface Tension and Chemical Constitution.

Since 1866, when Mendelejeff made his first attempt, many investigators have sought to trace the relations between the surface tensions of liquids and their chemical constitution. One of the most persistent and successful investigators in this direction has been R. Schiff, and it was in connection with this question that he introduced the new constant $N(=\alpha/M)$ into surface tension literature (see Table LXXIF); for the sake of convenience Schiff puts $N=1000\alpha/M$. He found that the influence of all constituent atoms can be expressed in terms of that of one hydrogen atom; thus the first substance given in the table referred to is hexane, and corresponds to twenty-six hydrogen "equivalents," as every carbon atom corresponds to 2H. We are given the equation—

$$N=\frac{1}{n}\cdot\epsilon^{(6\cdot483-0\cdot0168n)}$$

$$\mathrm{Log}_\epsilon N=6\cdot483-0\cdot0168n-\log_\epsilon n;$$

and in ordinary logarithms

$$\mathrm{Log}\,N=2\cdot81553-0\cdot007296n-\log n.$$

This equation gives 16·2 as the value of N for hexane, and the experimental results obtained by Schiff give 16·1.

The values for the various elements, as found by this investigator, are the following:—

C≡2H in nearly all compounds except in free acids.
≡3H in free acids.
O≡3H (oxygen linked to two carbon atoms, and also in several ring complexes, seems to exert no influence, so here O≡0H).
Cl≡7H generally.
≡6H when there are several chlorine atoms joined to different carbon atoms; also in the side chains of benzene compounds.
Br≡13H.
≡11H in ethylene bromide, propylene bromide, and free bromine.
I≡19H.
N≡0H (having no influence) in primary amines.
≡1H in secondary amines.
≡2H in the tertiary amines.
≡2H in nitro-groups.
≡3H in the CN group.
S≡5·5H.
P≡5H when trivalent.
≡4H when pentavalent.

It will be readily admitted that the relative values of these elements calculated from surface tension investigations ought to be, at least very nearly, in the same ratios as those computed from the molecular volumes (see Table LXXP, pages 684–686), and it is very

interesting to notice how closely the different sets of values agree in this respect. Kopp's values work out very nearly as follows:—

C≡2H.
5N≡2H in ammonias (? primary amines).
N≡3H in cyanides.
5N≡8H in nitro derivatives.
5O≡7H in hydroxyl group.
5O≡11H in carboxyl group.
$P^{iii}<5H$ (slightly).
$P^{v}<4H$ („).
Cl > 4H.
Br > 10H.
S > 5H.

Traube's values also show interesting coincidences:—

C≡3H.
N≡0·5H in ammonias.
≡3H in cyanides.
≡2·5H to 3H in nitro derivatives.
≡4H in tertiary amines.
8O≡1H in hydroxyl groups.
O≡0·75H when O is "extra-radicle."
≡2H in carboxyl groups.
$\left.\begin{array}{l} P^{iii}\equiv 5H \\ P^{v}\equiv 9H \end{array}\right\}$
S≡5H.

The series I≡19H, Br≡13H, and Cl≡7H, might lead us to expect that F would correspond to H; the volume value of fluorine as found by Thorpe is considerably less than double that assigned to hydrogen.

The values of N, computed from Schiff's investigations, are given in Table LXXIF; it will be seen that they are practically identical for all isomeric substances.

Sutherland concluded that "in compounds containing C, O, and H, the molecule may be considered to have a volume to which each atom of H contributes an amount very small in comparison with that contributed by an atom of O or C. . . . The volume of such a molecule can be expressed in terms of that of a carbon atom, and the *parameter A varies inversely as the surface of the molecule.*" From this and the equation given by Eotvös he concludes that

$$a = kA\sigma^{\frac{2}{3}}M^{\frac{1}{3}},$$

where k is approximately the same for all liquids. This investigator finds that an atom of oxygen directly linked to two atoms (O^{i}) has the same effect on the molecular volume as two atoms of carbon, while an atom directly united to only one atom (O^{ii}) has the same effect as three atoms of carbon; *i.e.*—

$$O^{i}\equiv 2C$$
$$O^{ii}\equiv 3C$$

If a molecule contain x atoms of carbon, y atoms O^{i}, and z atoms of O^{ii}, if we put

$$x+y+z=n,$$

we get

$$\text{molecular volume, } v \propto n,$$

and $av^{\frac{2}{3}} \propto an^{\frac{2}{3}}$;
but $n^{\frac{2}{3}} \propto$ surface of the molecule, and therefore $A^{-1} \propto n^{\frac{2}{3}}$ and $An^{\frac{2}{3}}$ = a constant;

$$\therefore \quad kAn^{\frac{2}{3}} = \text{a constant.}$$

Sutherland gives also the following values as approximation for elements other than oxygen:

$$Cl \equiv 5C \text{ or } 6C.$$
$$N \equiv 0{\cdot}8C \text{ to } 1C \text{ in amines.}$$
$$N \equiv 0{\cdot}6C \text{ in } NO_2 \text{ or } NO_3 \text{ groups.}$$

In cyanides the value of N seems to diminish as the molecular weight of the cyanide increases.

Sutherland's numbers do not agree very closely with his theory, but they are very suggestive. They are given below.

Substance.	Formula.	n.	kA.	Mean Value of kA.	kA$n^{\frac{2}{3}}$.
Methyl cyanide,	CH_3CN		1·094		
Allyl amine,	$NH_2C_3H_5$		0·950		
Propyl amine,	$NH_2C_3H_7$		940		
Ethyl cyanide,	C_2H_5CN		864		
Propyl cyanide,	C_3H_7CN		817		
Acetone,	$C_3H_6O^{ii}$		806		
Butyl amine,	$NH_2C_4H_9$		799	0·794	2·32
Amylene,	C_5H_{10}	5	794		
Diethyl amine,	$NH(C_2H_5)_2$		780		
Butyl cyanide,	C_4H_9CN		755		
Amyl amine,	$NH_2C_5H_{11}$		716		
Hexane,	C_6H_{14}	6	0·707		
Di-allyl,	C_6H_{10}	6	706		
Benzol,	C_6H_6	6	705	0·700	2·31
Pyridine,	NC_5H_5		703		
Ethyl oxide,	$C_4H_{10}O^{i}$	6	683		
Aniline,	$NH_2C_6H_5$		661		
Methyl thiocyanate,	CH_3CNS		647		
Ethyl sulphide,	$C_4H_{10}S$		634		
Methyl nitrite,	CH_3NO_2		0·632		
Toluol,	C_7H_8	7	620	0·620	2·27
Phenyl cyanide,	C_6H_5CN		601		
Triethyl amine,	$N(C_2H_5)_3$		600		
Ethyl thiocyanate,	C_2H_5CNS		0·595		
	$C_3H_6O^{i}O^{ii}$	8	589		
	C_8H_{10}	8	574		
	C_8H_{16}	8	573		
Cuminol,	$C_6H_{12}O^{i}$	8	568		
Furfurol,	$C_4H_2O^{i}HCOH$	?	565		
Ethyl nitrite,	$C_2H_5NO_2$		565	0·567	2·27
Allyl thiocyanate,	C_3H_5CNS		563		
Methyl-amyl ether,	$CH_3O^{i}C_5H_{11}$	8	560		
Dimethyl acetal,	$CH_3CH(O^{i}CH_3)_2$		554		
Octane,	C_8H_{18}	8	551		

TABLE LXXIB.—*continued.*

Substance.	Formula.	n.	kA.	Mean Value of kA.	$kAn^{\frac{2}{3}}$.
	$C_4H_8O^iO^{ii}$	9	0·540		
Isobutyl chloride,	C_4H_9Cl		525		
Dimethyl acetal,			523	0·525	2·27
Anisol,	$C_6H_5O^iCH_3$	9	521		
	C_9H_{12}	9	515		
Allyl acetate,	$C_5H_8O^iO^{ii}$	10	0·503		
Epichlorhydrin,	$CH_2ClC_2H_3O$		495		
	$C_5H_{10}O^iO^{ii}$	10	495		
Carbon disulphide,	CS_2		491		
Isoamyl chloride,	$C_5H_{11}Cl$		491		
Ethyl nitrate,	$C_2H_5NO_3$		484		
Decane,	$C_{10}H_{22}$	10	473		
Phenetol,	$C_6H_5O^iC_2H_5$	10	471	0·468	2·17
	$C_{10}H_{14}$	10	464		
Phenyl nitrite,	$C_6H_5NO_2$		463		
	$C_6H_{12}O^iO^{ii}$	11	461		
Diethyl acetal,	$CH_3CH(O^iC_2H_5)_2$	10	456		
Terpene,	$C_{10}H_{16}$	10	450		
Benzyl chloride,	C_7H_7Cl		445		
Carvol,	$C_{10}H_{14}O$	12?	0·444		
Phenyl chloride,	C_6H_5Cl		440		
Phenyl thiocyanate,	C_6H_5CNS				
	$C_7H_{14}O^iO^{ii}$	12	434	0·435	2·28
Resorcin,	$C_6H_2(O^iHCH_3)_2$	12	431		
Autobutyric anhydride,	$C_2H_3O^i{}_3C_4H_7$	12	431		
Cuminol,	$C_{10}H_{12}O^{ii}$	13	0·422		
Methyl benzoate,	$C_6H_5CO^iO^{ii}CH_3$	13	417		
	C_7H_7Cl		417	0·414	2·29
Ethylene chloride,	$C_2H_4Cl_2$		412		
	$C_8H_{16}O^iO^{ii}$	13	402		
Propylene chloride,	$C_3H_6Cl_2$		390		
Phosphoryl chloride,	$POCl$		388		
Amyl nitrate,	$C_5H_{11}NO_3$		388		
Ethyl benzoate,	$C_6H_5CO^iO^{ii}C_2H_5$	14	0·387	0·387	2·25
Paraldehyde,	$C^6H_{12}O_3^{ii}$	15	379	0·379	2·31
Benzoyl chloride,	$C_6H_5CO^{ii}Cl$		373		
Ethyl oxalate,	$(C_2H_5)_2C_2O^i{}_2O^{ii}{}_2$	16	365	0·365	2·32
Methyl paracresolate,	$C_6H_3O^iH<\begin{matrix}CO^iO^{ii}\\(CH_3)_2\end{matrix}$		362		
Ethyl monochloracetate,	$C_2H_2ClO^iO^{ii}C_2H_5$		359		
Benzylidene chloride,	$C_6H_5CHCl_2$		357		
Phosphorus sulphorchloride,	$PSCl$		356		
Trichlorethane,	$CH_2ClCHCl_2$				

From all these we get as a very fair average result,—

$$kAn^{\frac{2}{3}} = 2{\cdot}28.$$

Sutherland gave the values of kA for some nineteen other substances; these are given in the following table with the values of n calculated by the help of the preceding equation. The results indicate that Sutherland's equation is of only a comparatively limited application. The values of n can only be roughly approximate ones.

Substance.	kA.	n.
Br_2, ...	0·104	103
C_2H_5Br, ...	259	26
C_3H_7Br, ...	269	25
i–C_3H_7Br, ...	270	25
C_3H_5Br, ...	269	25
C_4H_9Br, ...	271	24
$C_5H_{11}Br$, ...	270	25
C_6H_5Br, ...	247	28
C_7H_7Br, ...	247	28
$C_2H_4Br_2$, ...	149	60
$C_3H_6Br_2$, ...	149	60
CH_3I, ...	150	59
C_2H_5I, ...	159	54
C_3H_7I, ...	171	48
i–C_3H_7I, ...	170	49
C_3H_5I,, ...	170	49
C_4H_9I, ...	176	47
$C_5H_{11}I$, ...	178	46
C_6H_5I, ...	168	51

TABLE LXXIs.—Surface Tension of Solids.

From the experimental results obtained by Karmarsch, Quincke calculated the following values for the surface tension of the various metals and alloys :—

Substance.	Values of α in 10^3 mgms.	
	Hard Drawn.	Annealed.
Iron,	5731	1592
Platinum,	3025	2388
Copper,	2388	0
Silver,	2388	478
Gold,	1592	478
Zinc,	557	
Steel,	6685	955
German silver,	6685	1114
Silver (12),	5253	2547
Gold (14 carat),	3661	2228
Brass wire,	2547	1751
„ threads,	1751	637

The order which the metals take in the first column of this table is practically that of their hardness.

TABLE LXXIt.—Laplace's Constant, K.

Laplace's expression for the pressure at a point in the interior of a liquid is

$$\text{Pressure} = K + \frac{H}{2}\left(\frac{1}{R} + \frac{1}{R_1}\right),$$

where $H/2 = \alpha =$ surface tension;

R and R_1 are the principal radii of curvature of the liquid surface;

$K =$ a pressure depending on the nature of the liquid, and always of a very considerable magnitude.

Laplace called K the "intrinsic pressure"; others have called it the "cohesion pressure," or the tensile strength of the absolutely pure liquid. It is virtually the same as a/v^2 in the equation of van der Waals. Dupré has given another interpretation of the magnitude K; it is the measure of the work required for removing a unit volume of the liquid and distributing its molecules in space so that they can no longer exert any attraction on one another. In short, $K =$ work done in vaporising a unit volume of liquid. Thus the work done in vaporising 1 cm.^{3} of water at 0° C. is 25206 mg.-ergs under a pressure of 1 atmosphere or 1013793 dynes per cm.^{2}, so K for water at 0° C. works out as 24,860 atmospheres. From the total heat of vaporisation we can calculate the value of K for any other liquid. The values obtained in this way, it will be seen, differ considerably from those calculated from van der Waal's equation.

Van der Waal's values for K at 0° C.

Ether,	1300 to 1430	atmospheres.
Alcohol,	2100 „ 2400	„
Carbon disulphide,	2900 „ 2890	„
Water,	10500 „ 10700	„
Ethyl chloride,	2040	„
Sulphur dioxide,	3060	„
Carbon dioxide,	2820	„
Methyl acetate,	2225	„
Diethyl amine,	1500	„

For seven of these we have sufficient data to calculate the approximate value of K from the latent heat, etc., at 0° C., and we get—

	Value of K.	
Ether,	2880	atmospheres.
Alcohol,	7680	„
Carbon disulphide,	4820	„
Water,	24860	„
Sulphur dioxide,	5450	„
Carbon dioxide,	2220	„
Methyl acetate,	4540	„

It is evident the two methods of calculation must refer to totally different magnitudes.

If a particle fairly within a liquid—*i.e.* further from the surface than the range of molecular action—move towards the surface with a velocity u, it is evident that it cannot cross that surface and escape from the liquid, unless

$$u^2 > 4K/\sigma.$$

TABLE LXXII. (A–H).—**PHYSICAL**

TABLE LXXIIA.—**Boiling Points and Concentration**

B.P. of Solution. $t°$ C.	Weight of Salt dissolved													
	NH_4Cl.		KCl.		NaCl.						LiCl.		$LiCl+2H_2O$.	
	Legrand.	Gerlach.	Legrand.	Gerlach.	Per cent. Legrand.	Legrand.	Per cent. Gerlach.	Gerlach.	Per cent. Bischof.	Per cent. Karsten.	Gerlach.	Skinner.		
100°·5			4·7	4·9		4·4		3·4						
100 ·6														
100 ·8					5									
100 ·9							5							
101	7·8	6·5	9·0	9·2		7·7		6·6			3·5	3·38	6·67	6·5
101 ·1										5				
101 ·5			13·2	13·1		10·8		9·6	5					
101 ·6														
101 ·75					10									
101 ·9							10							
102	13·9	12·8	17·1	16·7		13·4		12·4			7	6·54	13·76	13
102 ·38										10				
102 ·5			20·9	20·1		15·9		14·9						
103	19·7	19·0	24·5	23·4	15	18·3		17·2			10		20·19	19·5
103 ·03									10					
103 ·3							15							
103 ·5			28·0	26·7		20·7		19·4						
103 ·83										15				
104	25·2	24·7	31·4	29·9		23·1		21·5			12·5		25·84	26
104 ·4														
104 ·5			34·6	33·1		25·5		23·5						
104 ·6					20									
104 ·63									15					
105	30·5	29·7	37·8	36·2		27·7		25·5			15	13·04	31·77	32
105 ·3							20							
105 ·46										20				
105 ·5			41·0	39·3		29·8		27·5						
106	35·7	34·6	44·2	42·4		31·8		29·5			17·5		37·99	
106 ·2														
106 ·26									20					
106 ·5			47·4	45·5		33·9		31·5						
106 ·6					25									
106 ·7														
107	41·3	39·6	50·5	48·4		35·8		33·5			20	16·6	44·49	
107 ·27										25				
107 ·5			53·7	51·5		37·7		35·5						
107 ·6							25							
107 ·93									25					
108	47·3	45·0	56·9	54·5		39·7		37·5			22		50	
108 ·3			59·4											
108 ·4							41·2							
108 ·5				57·4				39·5						
108 ·8								40·7						
109	53·5	50·6												
110	59·9	56·2									24		55·7	
111	66·4	61·9									26		61·7	62
112	73·3	67·8									28	21·8	67·9	67·6
113	80·5	74·2									30		74·4	
114	88·1	81·3									32		81·2	
114 ·2	88·9										33·5		86·5	
114 ·8		87·1												
115														
115 ·6											35		92·0	92
116														
117											36·5		97·7	
117 ·45											38		103·7	
117 ·5														
118											39·5		109·8	

PROPERTIES OF SOLUTIONS.

of Aqueous Solutions.—1. Chlorides.

in 100 parts of Water.

MgCl$_2$.			MgCl$_2$+6H$_2$O.		CaCl$_2$.			CaCl$_2$+6H$_2$O.	SrCl$_2$.		SrCl$_2$ +6H$_2$O.	BaCl$_2$.		BaCl$_2$+2H$_2$O.
Per cent. Skinner.	Per cent. Gerlach.	Gerlach.			Legrand.	Per cent. Skinner.	Gerlach.		Legrand.	Gerlach.		Legrand.	Gerlach.	
												11	6·4	7·59
4·6		4·9	11·07	11	10	5·6	6·0	12·59	16·7	11	20·00	19·6	12·7	15·23
												26·2	19	23·04
	10													
8·4		9·2	21·93	22	16·5	10·3	11·5	25·58	25·2	20·5	40·09	32·5	25·3	31·35
												38·6	31·6	39·21
11·6		13·2	33·15	33	21·6	14·5	16·5	38·83	32·1	28·9	60·55	44·5	37·7	47·31
												50·3	43·7	55·45
14·3		16·7	44	44	25·8	17·5	21	52·15	37·9	36·2	80·86	56	49·5	63·5
												60·1		
													55·2	71·51
		19·9	54·88	55	29·4	20	25	65·28	43·4	43·2	103·02			
		22·5	64·51	66	32·6		29	79·84	48·8	49·6	126·85			
	20													
		25	74·52		35·6		32·5	90·39	54·0	55·4	149·79			
		27·5	85·36	88	38·5		35·5	107·16	59·0	60·8	174·74			
		29·9	96·6		41·3		38·5	121·7	63·9	66·2	203·0			
		32·3	108·9	110	44		41·5	137·0	68·9	71·4	234·1			
		34·6	121·6		46·8				74·1	76·5	269			
		36·6	133·7	133	49·7				79·6	81·6	309·6			
		38·4	145·3		52·6				85·3	87·0	360			
		40·2	157·8	157	55·6				91·2	93·1	429·1			
		41·8	169·8		58·6		55	234·2	97·5	99·5	520·9			
		43·4	181·8	183	61·6				104·0	105·9	668·0			
		44·9	195·4		64·6				110·9 (sat). 117°·5	112·3 (sat.)	1551·8			
		46·4	209·2	211	67·6									

TABLE LXXIIa.—**Boiling Points and Concentration**

B.P. of Solution. t° C.	Weight of Salt dissolved													
	NH_4Cl.		KCl.		NaCl.						LiCl.		$LiCl+2H_2O$.	
	Legrand.	Gerlach.	Legrand.	Gerlach.	Per cent. Legrand.	Legrand.	Per cent. Gerlach.	Gerlach.	Per cent. Bischof.	Per cent. Karsten.	Gerlach.	Skinner.		
119°											41		116·2	
120											42·5		122·8	123
121											44		129·7	
122											45·5		137·0	
123											47		144·5	
124											48·5		152·3	
125											50		160·5	160·5
126											51·5		169	
127											53		178	
128											54·5		187·4	
129											56		197·0	
130											57·5		207·5	207
130·4														
131											59		218·3	
132											60·5		229·7	
133											62		241·8	
134											63·5		254·5	
135											65		267·8	267·5
136											66·5		282·0	
137											68		297·0	
138											69·75		315·8	
139											71·5		335·9	
140											73·25		357·7	356·5
141											75		381·2	
142											77		410·5	
143											79		442·8	
144											81		478·6	
145											83		518·6	518·2
146											85		563·4	
147											87·5		627·6	
148											90		703·6	
149											92·5		794·4	
150											95		905·2	900
151											97·5		1042·9	
152											100		1219·3	1207·2
153											102·5		1453·1	
154											105		1777·6	
155											107·5		2259·6	2231·5
156											110·5		3305·7	3241·
157											113·5		5342·2	5518·4
158											116·5		18540·	16554
158·5											117·96			∞
159											119·5			
160											122·5			
161											125·5			
162											128·5			
163											131·5			
164											135			
165											138·5			
166											142·5			
167											146·5			
168											151			
170														
172														
174														
175														
176														
178														
179·5														

of Aqueous Solutions.—1. Chlorides—*continued.*

in 100 parts of Water.

$MgCl_2$.			$MgCl_2+6H_2O$.		$CaCl_2$.			$CaCl_2+6H_2O$.	$SrCl_2$.		$SrCl_2+6H_2O$.	$BaCl_2$.		$BaCl_2+2H_2O$.
Per cent. Skinner.	Per cent. Gerlach.	Gerlach.			Legrand.	Per cent. Skinner.	Gerlach.		Legrand.	Gerlach.		Legrand.	Gerlach.	
		47·9	224·1		70·6					(sat.)				
		49·4	240·1	241	73·6		69	416·3						
		50·8	256·1		76·7									
		52·2	273·5	274	79·8									
		53·6	292·7		82·9									
		55	312·5	313	86									
		56·4	334·6		89·1									
		57·7	357	356	92·2									
		59	381·3											
		60·3	407·9	410	98·4									
		61·6	437·2											
		62·9	469·4	471	104·6		101	12992						
							102·67	∞						
					110·9									
					117·2									
							119							
					123·5									
							137·5							
							157							
							178							
							200							
					203·0									
					212·1 ; (222)*									
					221·6									
					231·5									
					(245)									
					241·9									
					252·8									
					264·2 (268)									
					276·1									
					285·5									
					(292)									
					301·4									
					314·8 (305)									
					325									

* The numbers in brackets are Gerlach's.

TABLE LXXIIa.—*continued.*

2. Potassium Iodide, various Nitrates and Potassium Chlorate.

B. P. of Solution. t° C.	Weight of Salt dissolved in 100 parts of Water.																
	KI	NH_4NO_3		$NaNO_3$		KNO_3		$Ca(NO_3)_2$		$Ca(NO_3)_2+2H_2O$		$Sr(NO_3)_2$		$Ba(NO_3)_2$		$Pb(NO_3)_2$	
		Legrand.	Gerlach.	Legrand.	Gerlach.	Legrand.	Gerlach.	Legrand.	Gerlach.			Gerlach.	Various.	Gerlach.	Various.	Gerlach.	Various.
100·5							7·5					12		12·5		11	
101	15	10	10	9·3	9	12·2	15·2	15	10			24		26		26	
101·1														27·5	36·18(Gr.)		
101·5							23					34·8		(Sat.)		44	
101 65															35·2(G.L.)		
101·9															34·8 (M.)		
102	30	20·5	20	18·7	18·5	26·4	31	25·3	20	25·6	25·5	45				65	
102·2																	140 (Gr.)
102·5							39					54·4			34·8 (Kr.)	87	
103	45	31·3	30	28·2	28	42·2	47·5	34·4	30	39·1	39·5	63·6				111	
103·5							56					72·6				137	Sat.(Kr.)
104	60	42·4	41	37·9	38	59·6	64·5	42·6	40	53·5	53·5	81·4					
104·5							73					89·6					
105	74	53·8	52	47·7	48	78·3	82	50·4	50	68·5	68·5	97·6					
105·5												105					
106	87	65·4	63	57·6	58	98·2	101	57 8	60	84·3		112·2					
106·3												116·5					
106·5																	
106·8													112·9(Gr.)				
107	99·5	77·3	74	67·7	68	119·0	120·5	64·9	70	100·8		(Sat.)					
107·5																	
107·9													Sat. (M.)				
108	111·5	89·4	85	77·9	78·5	140·6	141·5	71·8	80	118·3							
109	123	101·9	96	88·3	89	163·0	164	78·6	89	134·9							
110	134	114·9	108	98·8	99·5	185·9	188 5	85·3	98	152·3	152·5						
111		128·4	120	109·5	110·5	209·2	215	91·9	106·5	169·6							
112	155	142·4	132	120·3	121·5	233·0	243	98·4	114·5	186·5							

113		156·9	145	131·3	133	257·6		104·8	122·5	204·4							
114	175	172	158	142·4	144·5	283·3	274	111·2	130	221·9							
115		188	172	153·7	156	310·2	306	117·5	137·5	240·3	240						
115·9						335·1	338·5										
116	195	204·4	187	165·2	168·5			123·8	144	256·9							
117		221·4	202	176·8	181			130	150·5	274·2							
118	215	238·4	217	188·6	194			136·1	157	292·3							
119		256·8	232	200·5	207·5			142·1	163·5	311·2							
110		275·3	248	212·6	222			148·1	170	330·9	331·5						
121			265	224·8					176	349·8							
122		314	283					160·1	182·5	371·5							
123			301						189	394·1							
124		354	319					172·2	195·5	417·9							
125			337						202	442 8	443·5						
126		396	356					184·5	208·5	469·2							
127			376						215·5	499							
128		440·2	396					197·0	222·5	530·8							
129			417						230	567							
130		487·4	439					209·5	237·5	605·6	607						
131			461						245	647							
132		537·3	484					222·2	253	694·5							
133			507						261·5	749·3							
134		590	530					235·1	270	809·2							
135			554						278·5	874·8	877						
136		645	578					248·1	287	947·1							
137			603						296	1031·9							
138		705·5	629					261·3	305	1127							
139			655						314·5	1240 5							
140		770·5	682					274·7	324	1370·5	1376						
141			719						333·5	1520							
142		840·6	737					288·4	343·5	1706·5							
143			765						354	1940·9							
144		915·5	793					302·6	364·5	2229·7							
145			823						375	2593·9	2614						
146		995·5	853					317·4	386	3094							
147			883						397·5	3821							
148		1081·5	914					333·2	409	4908							
149			945						420·5	6716							
150		1173·5	977					351·2	432·5	10551	10880						
151			1009					362·2	444·5	22926							

TABLE LXXIIA.—*continued.*

2. Potassium Iodide, various Nitrates and Potassium Chlorate—*continued.*

B. P. of Solution. $t°$ C.	Weight of Solution dissolved in 100 parts of Water.																
	KI	NH_4NO_3		$NaNO_3$		KNO_3		$Ca(NO_3)_2$		$Ca(NO_3)_2+2H_2O$		$Sr(NO_3)_2$		$Ba(NO_3)_2$		$Pb(NO_3)_2$	
		Legrand.	Gerlach.	Legrand.	Gerlach.	Legrand.	Gerlach.	Legrand.	Gerlach.			Gerlach.	Various.	Gerlach.	Various.	Gerlach.	Various.
152		1273	1043						455·68								
153			1079														
154		1383	1116														
155			1155														
156		1504	1196														
157			1238														
158		1637	1281														
159			1325														
160		1775	1370														
161			1417														
162		1923	1464														
163			1511														
164		2084	1558														
165			1606														
166			1653														
167			1700														
168			1748														
169			1796														
170			1844														
180		∞	2400														
190			3112														
200			4099														
210			5618														
220			9547														
230			16950														
240			∞														

TABLE LXXIIa.—*continued*.

3. Various Sulphates.

B. P. of Solution. $t°$ C.	Weight of Salt dissolved in 100 parts of Water.															
	$(NH_4)_2SO_4$	Na_2SO_4	$Na_2SO_4+10H_2O$	K_2SO_4	$MgSO_4$	$MgSO_4+7H_2O$	$ZnSO_4$	$ZnSO_4+7H_2O$	$FeSO_4$	$FeSO_4+7H_2O$	$MnSO_4$	$MnSO_4+4H_2O$	$CuSO_4$	$CuSO_4+5H_2O$	$K_2Al_2(SO_4)_4$	$K_2Al_2(SO_4)_4+24H_2O$
100°·5	7·8	9·5	24·5	7	8·8	20	13·1	26	17·7	38	17·1	27·5	21·3	38	17·0	35·5
101	15·4	18·0	52·8	14·5	16·7	41·5	25·0	55·5	34·4	88	32·1	56	36·9	73	30·2	74
101 ·5	22·8	26·0	87·9	22·1	23·5	64	37·7	88·5	50·4	158	46·2	87·5	48·0	102	41·8	117·8
101 ·6									53·2							
102	30·1	33·0	128·5	30	29·5	87·5	45·4	125·5			58·9	121	56·2	129	51·6	167·0
102 ·1				31·6												
102 ·2													(81·8 Gr.)			
102 ·4											68·4					
102 ·5	37·2	39·0	174·7		34·7	112	53·9	166·5					63·0	155	60·4	224
103	44·2	44·5	231·1		39·5	138	61·0	207·8					69·0	180	68·7	296
103 ·2		46·7														
103 ·5	51·1				43·8	166	68·0	264					74·9	205	76·7	392
104	58·0				47·7	196	74·9	323					80·1	229	83·9	515
104 ·2													82·2			
104 ·5	64·9				51·3	228	80·7	390							90·7	690
105	71·8				54·6	262	85·7	464							97·6	971
105 ·5	78·7														103·9	1449
106	85·5														110·5	2632
106 ·5	92·3														116·9	9091
106 ·7															120·55	∞
107	99·1															
107 ·5	105·9															
108	112·6				75(?)											
108 ·2	115·3															

TABLE LXXIIA.—*continued.*

4. Acetates, Borates, Phosphates, and Thiosulphates.

B. P. of Solution. t° C.	Weight of Salt dissolved in 100 parts of Water.									
	$NaC_2H_3O_2.3H_2O$	$KC_2H_3O_2$	$Pb(C_2H_3O_2)_2$	$Pb(C_2H_3O_2)_2.3H_2O$	$Na_2B_4O_7$	$Na_2B_4O_7.10H_2O$	Na_2HPO_4	$Na_2HPO_4.12H_2O$	$Na_2S_2O_3$	$Na_2S_2O_3.5H_2O$
100°·5					8·64	17·7	8·6			
101	14·9	6	79	106	17·2	39	17·2	24·9	14	23·8
101 ·5					26·5	63	25·8	58·7		
102	30	12	171	278	37·5	93·2	34·4	106·8	27	50
102 ·5					48·5	140	42·9	181·7		
103	46·1	18	265	552	61·2	254·2	51·4	310·8	39	78·6
103 ·5					75·4	452·4	59·9	592·2		
104	62·5	24·5	365	1047	90·8	898·5	68·4	1686·0	49·5	108·1
104 ·5					109·0	5555·5	76·9			
105	79·7	31	465	2387			85·3		59	139·3
105 ·5							93·7			
106	97·9		559	9098			102·1		68	174
106 ·5							110·5			
107	118·1		667						77	216
108	139		794						86	264
109	164·4		926						95	324
110	194	63·5	1064						104	400
111									113	
112	269·4								122	496
113									131·5	
114	387								141·5	626
115									152	819
116									164	1139
117									175·75	
118	609·9	98	1905						188	1765
119									201	
120	6250	134	3226						214·5	3346
121									229	
122									244	
123									262	
124									283	
125		171·5	6061						311	
126									348	
128										
130		212	18181							
135		256·5								
140		309								
145		371·5								
150		444·5								
155		526								
160		609								
	120°·5	161°	133°	106°·4	104°·6					117°
	∞	626	∞	∞	∞					∞

TABLE LXXIIA.—*continued.*

5. Alkaline, Carbonates, and Tartrates.

B. P. of Solution. $t°$ C.	Weight of Salt dissolved in 100 parts of Water.								
	Na_2CO_3		$Na_2CO_3 10H_2O$	K_2CO_3		$Na_2C_4H_4O_62H_2O$	$NaKC_4H_4O_6$	$NaKC_4H_4O_6 . 4H_2O$	$K_2C_4H_4O_6 . \frac{1}{2}H_2O$
	*L.	G.		L.	G.				
100°·5	7·5	5·2	15·4						
101	14·4	10·4	34·1	13	11·5	21·4	17·3	25	18
101·5	20·8	15·6	57·1						
102	26·7	20·8	86·7	22·5	22·5	44·4	34·5	53·5	36
102·5	32	26	125·5						
103	36·8	31·1	177·6	31	32	68·2	51·3	84	54
103·5	41	36·2	253·1						
104	44·7	41·2	369·4	38·8	40	93·9	68·1	118	72
104·5	47·9	46·2	576·9						
105		51·2	1052·9	46·1	47·5	121·3	84·8	157	90
106				53·1	54·5	150·9		208	108
107				59·6	61	183		266	126·5
108				65·9	67	218·8		340	145
109				71·9	73			426	163·5
110				77·6	78·5		171	554	182
111				83	83·5				
112				88·2	88·5			988	221
113				93·2	93·5				
114				98	98·5			2339	263
115				102·8	103·5		272·5	5510	284
120				127	127·5		390		
125				152	152·5		510		
130				178·1	181·5		671		
135				205	219·5		855		
140					(133°)		1087		
145							1429		
150							2000		
155							3125		
160							6666		
							165°	115°·6	
							∞	∞	

* L = Legrand ; G = Gerlach.

TABLE LXXIIA.—*continued.*

6. Hydrogen Oxalate, Tartrate, and Citrate.

B. P. $t°$ C.	Weight of Substance in 100 parts Water.			B. P. $t°$ C.	Weight of Substance in 100 parts Water.		
	Oxalate.	Tartrate.	Citrate.		Oxalate.	Tartrate.	Citrate.
	$H_2C_2O_4$	$H_2C_4H_4O_6$	$H_3C_6H_5O_7.H_2O$		$H_2C_2O_4$	$H_2C_4H_4O_6$	$H_3C_6H_5O_7.H_2O$
101°	19	17	29	135°			
102	40		58	136		805	
103	62	52	87	137			
104	86		116	138		890	
105	112	87	145	139			
106	140	105	176	140		980	
107	169		208	141			
108	199	141	243	142		1082	
109	230		280	143			
110	262	177	320	144		1199	
111			359	145			
112	342	214	399	146		1333	
113			442	147			
114	460	253	498	148		1492	
115			553	149			
116	628	292	614	150		1695	
117			685	151			
118	869	333	763	152		1923	
119			855	153			
120	1316	374	952	154		2222	
121				155			
122	2272	415	1234	156		2597	
123	3333			158		3077	
124	6250	460	1613	160		3774	
125	50000			162		4878	
126		507	2247	164		6666	
127				165			
128		556	3333	166		10000	
129				168		20000	
130		608	6250	169		40000	
131			10000	170			
132		663	166666		125°·2	170°	132°·5
133					∞	∞	∞
134		728					

TABLE LXXIIA.—*continued.*

7. Alkaline Hydroxides.

B. P. of Solution, $t°$ C.	Wt. in 100 pts. Water.		B. P. of Solution, $t°$ C.	Wt. in 100 pts. Water.		B. P. of Solution, $t°$ C.	Wt. in 100 pts. Water.	
	NaHO	KHO		NaHO	KHO		NaHO	KHO
105°	17	20·5	**170°**	187·0	137·0	**270°**	1739	343·5
110	30	34·5	**175**	208·3	144·8	**280**	2353	375·0
115	41	46·5	**180**	230	152·6	**290**	3571	408·2
120	51	57·5	**185**	254·5	160·4	**300**	6452	444·4
125	60·1	67·5	**190**	281·7	168·2	**305**	10526	
130	70·1	76·8	**195**	312·3	176·5	**310**	22222	484·0
135	81·1	85	**200**	345	185·0	**320**		526·3
140	93·5	92·5	**210**	425·5	202·0	**330**		571·5
145	106·5	99·8	**220**	526·3	219·8	**340**		623·6
150	120·4	106·5	**230**	645·2	240·9			
155	134·5	114·5	**240**	800	263·1			
160	150·8	121·7	**250**	1000	285·7		314°	
165	168·8	129 35	**260**	1333	312·5		∞	

TABLE LXXIIB.—**Vapour Tension and Boiling Points of Aqueous Solutions of Glycerol.** (Gerlach.)

Percentage of Glycerol.	Vapour Tension at 100° C.	Boiling Point under a pressure of 760 mms.	Percentage of Glycerol.	Vapour Tension at 100° C.	Boiling Point under a pressure of 760 mms.
100	64 mms.	290° C.	**78**	419 mms.	119° C.
99	87	239	**77**	430	118·2
98	107	208	**76**	440	117·4
97	126	188	**75**	450	116·7
96	144	175	**74**	460	116
95	162	164	**73**	470	115·4
94	180	156	**72**	480	114·8
93	198	150	**71**	489	114·2
92	215	145	**70**	496	113·6
91	231	141	**65**	553	111·3
90	247	138	**60**	565	109
89	263	135	**55**	593	107·5
88	279	132·5	**50**	618	106
87	295	130·5	**45**	639	105
86	311	129	**40**	657	104
85	326	127·5	**35**	675	103·4
84	340	126	**30**	690	102·8
83	355	124·5	**25**	704	102·3
82	370	123	**20**	717	101·8
81	384	122			
80	396	121	**10**	740	100·9
79	408	120			

TABLE LXXIIc.—1. **Specific Gravity, etc., of Ammonia Solutions at 14° C.** (Carius.)

Specific Gravity.	Percent. of NH_3.	Specific Gravity.	Percent. of NH_3.	Specific Gravity.	Percent. of NH_3.	Specific Gravity.	Percent. of NH_3.	Specific Gravity.	Percent. of NH_3.
0·8844	36·0	0·9006	28·8	0·9203	21·6	0·9434	14·4	0·9701	7·2
48	35·8	11	28·6	09	21·4	41	14·2	09	7·0
52	35·6	16	28·4	15	21·2	49	14·0	17	6·8
56	35·4	21	28·2	21	21·0	56	13·8	25	6·6
60	35·2	26	28·0	27	20·8	63	13·6	33	6·4
64	35·0	31	27·8	33	20·6	70	13·4	41	6·2
68	34·8	36	27·6	39	20·4	77	13·2	49	6·0
72	34·6	41	27·4	45	20·2	84	13·0	57	5·8
77	34·4	47	27·2	51	20·0	91	12·8	65	5·6
81	34·2	52	27·0	57	19·8	98	12·6	73	5·4
85	34·0	57	26·8	64	19·6	0·9505	12·4	81	5·2
89	33·8	63	26·6	71	19·4	12	12·2	90	5·0
94	33·6	68	26·4	77	19·2	20	12·0	99	4·8
98	33·4	73	26·2	83	19·0	27	11·8	0·9807	4·6
0·8903	33·2	78	26·0	89	18·8	34	11·6	15	4·4
07	33·0	83	25·8	96	18·6	42	11·4	23	4·2
11	32·8	89	25·6	0·9302	18·4	49	11·2	31	4·0
16	32·6	94	25·4	08	18·2	56	11·0	39	3·8
20	32·4	0·9100	25·2	14	18·0	63	10·8	47	3·6
25	32·2	06	25·0	21	17·8	71	10·6	55	3·4
29	32·0	11	24·8	27	17·6	78	10·4	64	3·2
34	31·8	16	24·6	33	17·4	86	10·2	73	3·0
38	31·6	22	24·4	40	17·2	93	10·0	82	2·8
43	31·4	27	24·2	47	17·0	0·9601	9·8	90	2·6
48	31·2	33	24·0	53	16·8	08	9·6	99	2·4
53	31·0	39	23·8	60	16·6	16	9·4	0·9907	2·2
57	30·8	45	23·6	66	16·4	23	9·2	15	2·0
62	30·6	50	23·4	73	16·2	31	9·0	24	1·8
67	30·4	56	23·2	80	16·0	39	8·8	32	1·6
71	30·2	62	23·0	86	15·8	47	8·6	41	1·4
76	30·0	68	22·8	93	15·6	54	8·4	50	1·2
81	29·8	74	22·6	0·9400	15·4	62	8·2	59	1·0
86	29·6	80	22·4	07	15·2	70	8·0	67	0·8
91	29·4	85	22·2	14	15·0	77	7·8	75	0·6
96	29·2	91	22·0	20	14·8	85	7·6	83	0·4
0·9001	29·0	97	21·8	27	14·6	93	7·4	91	0·2

TABLE LXXIIc.—*continued.*

2. Specific Gravity, etc., of Ammonia Solutions at 15° C. (Grüneberg and Gerlach.)

Sp. Gr.	Percent. NH_3.	Sp. Gr.	Percent. NH_3.	Sp. Gr.	Percent. NH_3.	Sp. Gr.	Percent. NH_3.	Sp. Gr.	Percent. NH_3.	Sp. Gr.	Percent. NH_3.
0·880	35·50	0·900	27·70	0·920	21·30	0·940	15·45	0·960	9·80	0·980	4·50
885	33·40	905	26·00	925	19·80	945	14·00	965	8·40	985	3·30
890	31·40	910	24·40	930	18·35	950	12·60	970	7·05	990	2·15
895	29·50	915	22·85	935	16·90	955	11·20	975	5·75	995	1·05

3. Specific Gravity, etc., of Ammonia Solutions at 15° C. (Lunge and Wiernik.)

Specific Gravity.	Change of Sp. Gr. for 1°.	Percentage of NH_3.	1 Litre holds NH_3 in Grms.	1 Foot Cube contains NH_3 in lbs.	Specific Gravity.	Change of Sp. Gr. for 1°.	Percentage of NH_3.	1 Litre holds NH_3 in Grms.	1 Foot Cube contains NH_3 in lbs.
1·000	$0{\cdot}0_{3}18$	0·00	0·0	0·000	0·940	$0{\cdot}0_{3}39$	15·63	146·9	9·170
0·998	18	0·45	4·5	0·281	938	40	16·22	152·1	9·495
996	19	0·91	9·1	0·624	936	41	16·82	157·4	9·826
994	19	1·37	13·6	0·849	934	41	17·42	162·7	10·157
992	20	1·84	18·2	1·136	932	42	18·03	168·1	10·494
990	20	2·31	22·9	1·430	930	42	18·64	173·4	10·825
988	21	2·80	27·7	1·729	928	43	19·25	178·6	11·149
986	21	3·30	32·5	2·029	926	44	19·87	184·2	11·449
984	22	3·80	37·4	2·335	924	45	20·49	189·3	11·817
982	22	4·30	42·2	2·634	922	46	21·12	194·7	12·154
980	23	4·80	47·0	2·934	920	47	21·75	200·1	12·482
978	23	5·30	51·8	3·233	918	48	22·39	205·6	12·835
976	24	5·80	56·6	3·533	916	49	23·03	210·9	13·166
974	24	6·30	61·4	3·833	914	50	23·68	216·3	13·503
972	25	6·80	66·1	4·126	912	51	24·33	221·9	13·852
970	25	7·31	70·9	4·426	910	52	24·99	227·4	14·196
968	26	7·82	75·7	4·726	908	53	25·65	232·9	14·539
966	26	8·33	80·5	5·025	906	54	26·31	238·3	14·876
964	27	8·84	85·2	5·319	904	55	26·98	243·9	15·226
962	28	9·35	89·9	5·622	902	56	27·65	249·4	15 569
960	29	9·91	95·1	5·937	900	57	28·33	255·0	15·919
958	30	10·47	100·3	6·260	898	58	29·01	260·5	16·262
956	31	11·03	105·4	6·573	896	59	29·69	266·0	16·605
954	32	11·60	110·7	6·911	894	60	30·37	271·5	16·949
952	33	12·17	115·9	7·235	892	60	31·05	277·0	17·292
950	34	12·74	121·0	7·553	890	61	31·75	282·6	17·642
948	35	13·31	126·2	7·878	888	62	32·50	288·6	18·016
946	36	13·88	131·3	8·197	886	63	33·25	294·6	18·391
944	37	14·46	136·5	8·521	884	64	34·10	301·4	18·815
942	38	15·04	141·7	8·846	882	65	34·95	308 3	19·246

By dividing "grammes per litre" by 100 we get approximately "Pounds per gallon."

TABLE LXXIIc.—*continued.*

4. Specific Gravity, etc., of Alkaline Solutions. (Schiff and Gerlach.)

Percentage of Alkali.	Specific Gravity for Solutions of			Percentage of Alkali.	Specific Gravity for Solutions of			Percentage of Alkali.	Specific Gravity for Solutions of	
	NH_3.	NaOH.	KOH.		NH_3.	NaOH.	KOH.		NaOH.	KOH.
1	0·9959	1·012	1·009	25	0·9106	1·279	1·230	49	1·529	1·525
2	9915	024	017	26	9078	290	241	50	540	539
3	9873	035	025	27	9052	300	252	51	550	552
4	9831	046	033	28	9026	310	264	52	560	565
5	9790	058	041	29	9001	321	276	53	570	578
6	9740	070	049	30	8976	332	288	54	580	590
7	9709	081	058	31	8953	343	300	55	591	604
8	9670	092	065	32	8929	353	311	66	601	618
9	9631	103	074	33	8907	363	324	57	611	630
10	9593	115	083	34	8885	374	336	58	622	642
11	9556	126	092	35	8864	384	349	59	633	655
12	9520	137	101	36	8844	395	361	60	643	667
13	9484	148	110	37		405	374	61	654	681
14	9449	159	119	38		415	387	62	664	695
15	9414	170	128	39		426	400	63	674	705
16	9380	181	137	40		437	412	64	684	718
17	9347	192	146	41		447	425	65	695	729
18	9314	202	155	42		457	438	66	705	740
19	9283	213	166	43		468	450	67	715	754
20	9251	225	177	44		478	462	68	726	768
21	9221	236	188	45		488	475	69	737	780
22	9191	247	198	46		499	488	70	748	790
23	9162	258	209	47		509	499			
24	9133	269	220	48		519	511			

TABLE LXXIIc.—*continued.*

5. Specific Gravity, etc., of Caustic Soda Solutions at 15° C. (Hager.)

Sp. Gr.	Percent. NaOH.	Sp. Gr.	Percent. NaOH.	Sp. Gr.	Percent. NaOH.	Sp. Gr.	Percent. NaOH.	Sp. Gr.	Percent. NaOH.
1·0070	0·61	1·0787	6·76	1·1662	14·75	1·2687	24·24	1·3913	35·65
0105	0·9	0827	7·31	1697	15·0	2748	24·81	3981	36·25
0107	1·0	0868	7·66	1755	15·5	2800	25·3	4049	36·86
0141	1·2	0909	8·0	1803	15·91	2857	25·8	4118	37·47
0177	1·6	0951	8·34	1852	16·38	2905	26·31	4187	38·13
0213	2·0	0992	8·68	1901	16·77	2973	26·83	4267	38·8
0249	2·36	1030	9·0	1950	17·22	3032	27·31	4328	39·39
0286	2·71	1077	9·42	2000	17·67	3091	27·8	4410	40·0
0318	3·0	1120	9·74	2050	18·12	3151	28·31	4472	40·75
0360	3·35	1158	10·0	2101	18·58	3211	28·83	4545	41·41
0397	3·67	1195	10·5	2148	19·0	3272	29·38	4619	42·12
0435	4·0	1250	10·97	2202	19·58	3339	30·0	4694	42·83
0473	4·32	1294	11·42	2250	20·0	3395	30·57	4769	43·66
0511	4·64	1339	11·84	2308	20·59	3458	31·22	4845	44·38
0549	4·96	1383	12·24	2361	21·0	3521	31·85	4922	45·27
0588	5·29	1423	12·64	2414	21·42	3585	32·47	5000	46·15
0627	5·58	1474	13·0	2462	22·0	3642	33·0	5079	46·87
0667	5·87	1520	13·55	2522	22·64	3714	33·69	5158	47·60
0706	6·21	1566	13·86	2576	23·15	3780	34·38	5238	48·81
0746	6·55	1631	14·5	2632	23·67	3858	35·0	5319	49·02

TABLE LXXIIc.—*continued.*

6. Specific Gravity, etc., of Caustic Soda Solutions at 15° C. (Lunge.)

Specific Gravity.	Degrees.		Percentage of		1 Metre Cube contains		1 Foot Cube contains	
	Baumé.	Twaddell.	Na_2O.	NaOH.	Kilos. Na_2O	Kilos. NaOH	lbs. Na_2O	lbs. NaOH
1·007	1	1·4	0·47	0·61	4	6	0·25	0·37
014	2	2·8	0·93	1·20	9	12	0·56	0·76
022	3	4·4	1·55	2·00	16	21	0·99	1·28
029	4	5·8	2·10	2·71	22	28	1·35	1·74
036	5	7·2	2·60	3·35	27	35	1·68	2·17
045	6	9·0	3·10	4·00	32	42	2·02	2·61
052	7	10·4	3·60	4·64	38	49	2·36	3·05
060	8	12·0	4·10	5·29	43	56	2·71	3·50
067	9	13·4	4·55	5·87	49	63	3·03	3·91
075	10	15·0	5·08	6·55	55	70	3·41	4·40
083	11	16·6	5·67	7·31	61	79	3·83	4·94
091	12	18·2	6·20	8·00	68	87	4·22	5·45
100	13	20·0	6·73	8·68	74	95	4·62	5·96
108	14	21·6	7·30	9·42	81	104	5·05	6·51
116	15	23·2	7·80	10·06	87	112	5·43	7·01
125	16	25·0	8·50	10·97	96	123	5·97	7·70
134	17	26·8	9·18	11·84	104	134	6·49	8·38
142	18	28·4	9·80	12·64	112	144	6·99	9·01
152	19	30·4	10·50	13·55	121	156	7·55	9·74
162	20	32·4	11·14	14·37	129	167	8·08	10·42
171	21	34·5	11·73	15·13	137	177	8·57	11·06
180	22	36·0	12·33	15·91	146	188	9·08	11·72
190	23	38·0	13·00	16·77	155	200	9·66	12·46
200	24	40·0	13·70	17·67	164	212	10·26	13·24
210	25	42·0	14·40	18·58	174	225	10·88	14·03
220	26	44·0	15·18	19·58	185	239	11·57	14·92
231	27	46·2	15·96	20·59	196	253	12·26	15·82
241	28	48·2	16·76	21·42	208	266	12·98	16·75
252	29	50·4	17·55	22·64	220	283	13·72	17·69
263	30	52·6	18·35	23·67	232	299	14·47	18·66
274	31	54·8	19·23	24·81	245	316	15·29	19·73
285	32	57·0	20·00	25·80	257	332	16·04	20·69
297	33	59·4	20·80	26·83	270	348	16·84	21·73
308	34	61·6	21·55	27·80	282	364	17·60	22·71
320	35	64·0	22·35	28·83	295	381	18·42	23·76
332	36	66·4	23·20	29·93	309	399	19·29	24·88

TABLE LXXIIc.—*continued.*

6. Specific Gravity, etc., of Caustic Soda Solutions at 15° C.—*continued.*

Specific Gravity.	Degrees.		Percentage of		1 Metre Cube contains		1 Foot Cube contains	
	Baumé.	Twaddell.	Na_2O.	NaOH.	Kilos. Na_2O	Kilos. NaOH	lbs. Na_2O.	lbs. NaOH.
1·345	37	69·0	24·20	31·22	326	420	20·32	26·21
357	38	71·4	25·17	32·47	342	441	21·32	27·51
370	39	74·0	26·12	33·69	359	462	22·34	28·82
383	40	76·6	27·10	34·96	375	483	23·40	30·18
397	41	79·4	28·10	36·25	392	506	24·51	31·61
410	42	82 0	29·05	37·47	410	528	25·57	32·98
424	43	84·8	30·08	38·80	428	553	26·74	34·49
438	44	87·6	31·00	39·99	446	575	27·83	35·90
453	45	90·6	32·10	41·41	466	602	29·12	37·56
468	46	93·6	33·20	42·83	487	629	30·43	39·25
483	47	96·6	34·40	44·38	510	658	31·85	41·07
498	48	99·6	35·79	46·15	535	691	33·47	43·18
514	49	102·8	36·90	47·60	559	721	34·88	44·99
530	50	106·0	38·00	49·02	581	750	36·29	46·82

TABLE LXXIIc.—*continued.*

7. Density, etc., of Caustic Soda Solutions at 15° C. (Pickering.)
(Water at 4° C. = 1.)

By dividing the number representing "Grammes per litre" by 100 we get practically "Pounds avoirdupois per gallon."

Percent. NaOH.	Density.	Grammes NaOH per litre.	Pounds Av. NaOH per cubic foot	Percent. NaOH.	Density.	Grammes NaOH per litre.	Pounds Av. NaOH per cubic foot.
0	0·999180			26	1·287990	334·877	20·91
1	1·010611	10·106	0·63	27	298877	350·697	21·98
2	021920	20·438	1·28	28	309708	366·718	22·89
3	033109	30·993	1·93	29	320496	382·944	23·90
4	044317	41·773	2·61	30	331213	399·364	24·93
5	055463	52·773	3·29	31	341879	415·982	25·97
6	066602	63·996	3·99	32	352472	432·791	27·02
7	077733	75·441	4·71	33	362991	449·787	28·08
8	088856	87·108	5·44	34	373453	466·974	29·15
9	099969	98·997	6·24	35	383815	484·335	30·24
10	111069	111·107	6·94	36	394092	501·873	31·33
11	122165	123·538	7·71	37	404279	519·583	32·44
12	133250	135·990	8·49	38	414363	537·438	33·55
13	144353	148·766	9·29	39	424353	555·497	34·68
14	155450	161·763	10·10	40	434299	573·719	35·82
15	166538	174·980	10·93	41	444161	592·106	36·96
16	177619	188·319	11·77	42	453929	610·640	38·12
17	188707	202·280	12·63	43	463623	629·358	39·29
18	199783	215·961	13·48	44	473249	648·230	40·47
19	210861	230·064	14·36	45	482850	667·282	41·66
20	221933	244·387	15·26	46	492406	686·517	42·86
21	233062	258·943	16·16	47	501927	705·906	44·07
22	244119	273·706	17·08	48	511412	725·478	45·29
23	255134	288·681	18·02	49	520868	745·225	46·52
24	266092	303·862	18·97	50	530282	765·141	47·77
25	277063	319·266	19·93				

Hager found that with 10·19% NaOH the sp. gr. changes 0·0002 for each degree change of temperature.

20·29	"	"	0·0003	"	"
30·39	"	"	0·0004	"	"
40·50	"	"	0·00045	"	"

Kohlrausch gives for NaOH solutions at 15° C.:—

Percentage NaOH.	Sp Gr.	Percentage NaOH.	Sp. Gr.
2·5	1·0280	20	1·2262
5	0568	25	2823
10	1131	30	3374
15	1790		

Hager gives for Na_2O solutions at 15° C.:—

Percentage Na_2O.	Sp. Gr.	Percentage Na_2O.	Sp. Gr.
5	1·069	25	1·353
10	139	30	426
15	210	35	500
20	281		

TABLE LXXIIc.—*continued.*

8. Specific Gravity, etc., of Caustic Potash Solutions at 15° C. (Tünnermann.)

Specific Gravity.	Percentage of		Specific Gravity.	Percentage of		Specific Gravity.	Percentage of	
	KOH.	K_2O.		KOH.	K_2O.		KOH.	K_2O.
1·0050	0·738	0·5658	1·1702	19·542	16·408	1·34	38·28	32·14
0153	2·021	1·697	1839	20·890	17·510	36	39·85	33·46
0260	3·369	2·829	1979	22·237	18·671	38	41·37	34·74
0369	4·717	3·961	2122	23·585	19·803	40	42·86	35·99
0478	5·957	5·002	2268	24·933	20·935	42	45·22	37·97
0589	7·412	6·224	2342	25·606	21·500	44	47·84	40·17
0703	8·760	7·355	2493	26·954	22·632	46	50·39	42·31
0819	10·108	8·487	2648	28·303	23·764	48	52·88	44·40
0938	11·456	9·619	2805	29·650	24·895	50	55·32	46·45
1059	12·803	10·750	2966	30·998	26·027	52	57·71	48·46
1182	14·151	11·882	3131	32·345	27·158	54	59·65	50·09
1308	15·498	13·013	3300	33·693	28·290	56	61·43	51·58
1437	16·846	14·145	30	34·94	29·34	58	63·19	53·06
1568	18·195	15·277	32	36·91	30·74			

9. Specific Gravity, etc., of Caustic Potash Solutions at 15° C. (Gerlach.)

Percentage.	Specific Gravity for		Percentage.	Specific Gravity for		Percentage.	Specific Gravity for		Percentage.	Specific Gravity for	
	K_2O.	KOH.		K_2O.	KOH.		K_2O.	KOH.		K_2O.	KOH.
1	1·010	1·009	**16**	1·166	1·137	**31**	1·370	1·300	**46**	1·600	1·488
2	020	017	**17**	178	146	**32**	385	311	**47**	615	499
3	030	025	**18**	190	155	**33**	403	324	**48**	630	511
4	039	033	**19**	202	166	**34**	418	336	**49**	645	527
5	048	041	**20**	215	177	**35**	431	349	**50**	660	539
6	058	049	**21**	230	189	**36**	445	361	**51**	676	552
7	068	058	**22**	242	198	**37**	460	374	**52**	690	565
8	078	065	**23**	256	209	**38**	475	387	**53**	705	578
9	089	074	**24**	270	220	**39**	490	400	**54**	720	590
10	099	083	**25**	285	230	**40**	504	411	**55**	733	604
11	110	092	**26**	300	241	**41**	522	425	**56**	746	618
12	121	101	**27**	312	252	**42**	539	438	**57**	762	630
13	132	110	**28**	326	264	**43**	564	450	**58**	780	641
14	143	119	**29**	340	278	**44**	570	462	**59**	795	655
15	154	128	**30**	355	288	**45**	584	472	**60**	810	667

TABLE LXXIIc.—*continued.*

10. Specific Gravity, etc., of Caustic Potash Solutions at 15° C. (Lunge.)

Specific Gravity.	Degrees.		Percentage of		1 Metre Cube contains		1 Foot Cube contains	
	Baumé.	Twaddell.	K_2O.	KOH.	Kgms. K_2O	Kgms. KOH	lbs. K_2O	lbs. KOH
1·007	1	1·4	0·7	0·9	7	9	0·46	0·55
014	2	2·8	1·4	1·7	14	17	0·89	1·06
022	3	4·4	2·2	2·6	22	26	1·40	1·67
029	4	5·8	2·9	3·5	30	36	1·86	2·22
037	5	7·4	3·8	4·5	39	46	2·46	2·93
045	6	9·0	4·7	5·6	49	58	3·07	3·65
052	7	10·4	5·4	6·4	57	67	3·55	4·23
060	8	12·0	6·2	7·4	66	78	4·10	4·89
067	9	13·4	6·9	8·2	74	88	4·60	5·48
075	10	15·0	7·7	9·2	83	99	5·17	6·16
083	11	16·6	8·5	10·1	92	109	5·75	6·85
091	12	18·2	9·2	10·9	100	119	6·27	7·48
100	13	20·0	10·1	12·0	111	132	6·94	8·26
108	14	21·6	10·8	12·9	119	143	7·47	8·90
116	15	23·2	11·6	13·8	129	153	8·08	9·63
125	16	25·0	12·4	14·8	140	167	8·71	10·38
134	17	26·8	13·2	15·7	150	178	9·34	11·13
142	18	28·4	13·9	16·5	159	188	9·91	11·81
152	19	30·4	14·8	17·6	170	203	10·64	12·68
162	20	32·4	15·6	18·6	181	216	11·32	13·48
171	21	34·2	16·4	19·5	192	228	11·99	14·28
180	22	36·0	17·2	20·5	203	242	12·67	15·10
190	23	38·0	18·0	21·4	214	255	13·37	15·93
200	24	40·0	18·8	22·4	226	269	14·08	16·78
210	25	42·0	19·6	23·3	237	282	14·81	17·64
220	26	44·0	20·3	24·2	248	295	15·46	18·42
231	27	46·2	21·1	25·1	260	309	16·21	19·32
241	28	48·2	21·9	26·1	272	324	16·97	20·22
252	29	50·4	22·7	27·0	284	338	17·74	21·14
263	30	52·6	23·5	28·0	297	353	18·53	22·08
274	31	54·8	24·2	28·9	308	368	19·25	22·93
285	32	57·0	25·0	29·8	321	383	20·05	23·90
297	33	59·4	25·8	30·7	335	398	20·89	24·89
308	34	61·6	26·7	31·8	349	416	21·80	25·98
320	35	64·0	27·5	32·7	363	432	22·66	27·00
332	36	66·4	28·3	33·7	377	449	23·53	28·04
345	37	69·0	29·3	34·9	394	469	24·60	29·31
357	38	71·4	30·2	35·9	410	487	25·58	30·48
370	39	74·0	31·0	36·9	425	506	26·51	31·59

TABLE LXXIIc.—*continued.*

10. Specific Gravity, etc., of Caustic Potash Solutions at 15° C.—*continued.*

Specific Gravity.	Degrees.		Percentage of		1 Metre Cube contains		1 Foot Cube contains	
	Baumé.	Twaddell.	K_2O.	KOH.	Kgms. K_2O	Kgms. KOH	lbs. K_2O	lbs. KOH
1·383	40	76·6	31·8	37·8	440	522	27·45	32·71
397	41	79·4	32·7	38·9	457	543	28·52	33·98
410	42	82·0	33·5	39·9	472	563	29·49	35·13
424	43	84·8	34·4	40·9	490	582	30·59	36·44
438	44	87·6	35·4	42·1	509	605	31·78	37·86
453	45	90·6	36·5	43·4	530	631	33·11	39·45
468	46	93·6	37·5	44·6	549	655	34·37	40·95
483	47	96·6	38·5	45·8	571	679	35·64	42·47
498	48	99·6	39·6	47·1	593	706	37·03	44·12
514	49	102·8	40·6	48·3	615	731	38·37	45·72
530	50	106·0	41·5	49·4	635	756	39·64	47·23
546	51	109·2	42·5	50·6	655	779	41·02	48·87
563	52	112·6	43·6	51·9	681	811	42·54	50·69
580	53	116·0	44·7	53·2	706	840	44·09	52·54
597	54	119·4	45·8	54·5	731	870	45·66	54·40
615	55	123·0	47·0	55·9	759	905	47·38	56·46
634	56	126·8	48·3	57·5	789	940	49·27	58·70

11. Specific Gravity, etc., of Ammonium Carbonate Solutions at 15° C. (Lunge.)

Specific Gravity.	Degrees Twaddell.	Percentage of Am. Carb.	Specific Gravity.	Degrees Twaddell.	Percentage of Am. Carb.	Specific Gravity.	Degrees Twaddell.	Percentage of Am. Carb.
1·005	1	1·66	1·055	11	16·16	1·105	21	31·77
010	2	3·18	060	12	17·70	110	22	33·45
015	3	4·60	065	13	19·18	115	23	35·08
020	4	6·04	070	14	20·70	120	24	36·88
025	5	7·49	075	15	22·25	125	25	38·71
030	6	8·93	080	16	23·78	130	26	40·34
035	7	10·35	085	17	25·31	135	27	42·20
040	8	11·86	090	18	26·82	140	28	44·29
045	9	13·36	095	19	28·33	144	29	44·90
050	10	14·83	100	20	29·93			

TABLE LXXIIc.—*continued.*

12. Specific Gravity, etc., of Sodium Carbonate Solutions at 23° C. (Schiff.)

Specific Gravity.	Percentage of $Na_2CO_3 + 10H_2O$.	Percentage of Na_2CO_3.	Specific Gravity.	Percentage of $Na_2CO_3 + 10H_2O$.	Percentage of Na_2CO_3.
1·0038	1	0·370	1·1035	26	9·635
0076	2	0·741	1076	27	10·005
0114	3	1·112	1117	28	10·376
0153	4	1·482	1158	29	10·746
0192	5	1·853	1200	30	11·118
0231	6	2·223	1242	31	11·488
0270	7	2·594	1284	32	11·859
0309	8	2·965	1326	33	12·230
0348	9	3·335	1368	34	12·600
0388	10	3·706	1410	35	12·971
0428	11	4·076	1452	36	13·341
0468	12	4·447	1494	37	13·712
0508	13	4·817	1536	38	14·082
0548	14	5·188	1578	39	14·453
0588	15	5·558	1620	40	14·824
0628	16	5·929	1662	41	14·195
0668	17	6·299	1704	42	15·566
0708	18	6·670	1746	43	15·936
0748	19	7·041	1788	44	16·307
0789	20	7·412	1830	45	16·677
0830	21	7·782	1873	46	17·048
0871	22	8·153	1916	47	17·418
0912	23	8·523	1959	48	17·789
0953	24	8·894	2002	49	18·159
0994	25	9·264	2015	50	18·530

TABLE LXXIIc.—*continued.*

13. Specific Gravity, etc., of Sodium Carbonate Solutions at 15° C. (Lunge.)

Specific Gravity.	Degrees Baumé.	Degrees Twaddell.	Percentage of		Kilogrammes in each Metre Cube of the Liquid.		Pounds in each Foot Cube of Liquid.	
			Na_2CO_3.	$Na_2CO_3+10H_2O$.	Na_2CO_3.	$Na_2CO_3+10H_2O$.	Na_2CO_3.	$Na_2CO_3+10H_2O$.
1·007	1	1·4	0·67	1·807	6·8	18·2	0·42	1·14
014	2	2·8	1·33	3·587	13·5	36·4	0·84	2·27
022	3	4·4	2·09	5·637	21·4	57·6	1·34	3·60
029	4	5·8	2·76	7·444	28·4	76·6	1·77	4·77
036	5	7·2	3·43	9·251	35·5	95·8	2·22	5·96
045	6	9·0	4·29	11·570	44·8	120·9	2·80	7·55
052	7	10·4	4·94	13·323	52·0	140·2	3·25	8·74
060	8	12·0	5·71	15·400	60·5	163·2	3·78	10·19
067	9	13·4	6·37	17·180	68·0	183·3	4·24	11·44
075	10	15·0	7·12	19·203	76·5	206·4	4·78	12·88
083	11	16·6	7·88	21·252	85·3	230·2	5·33	14·37
091	12	18·2	8·62	23·248	94·0	253·6	5·87	15·83
100	13	20·0	9·43	25·432	103·7	279·8	6·47	17·47
108	14	21·6	10·19	27·482	112·9	304·5	7·05	19·01
116	15	23·2	10·95	29·532	122·2	329·6	7·63	20·36
125	16	25·0	11·81	31·851	132·9	358·3	8·30	22·37
134	17	26·8	12·61	34·009	143·0	385·7	8·93	24·08
142	18	28·4	13·16	35·493	150·3	405·3	9·38	25·30
152	19	30·4	14·24	38·405	164·1	442·4	10·24	27·62

TABLE LXXIIc.—*continued.*

14. Strength, etc., of Concentrated Solutions of Sodium Carbonate at 30° C. (Lunge.)

A.

Specific Gravity at 30°.	Degrees Twaddell.	Percentage by Weight of		Each Litre contains in grms.		Each Foot Cube contains in pounds	
		Na_2CO_3.	$Na_2CO_3+10H_2O$.	Na_2CO_3.	$Na_2CO_3+10H_2O$.	Na_2CO_3.	$Na_2CO_3+10H_2O$.
1·310	62	28·13	75·91	368·5	994·5	23·00	62·08
300	60	27·30	73·67	354·9	957·4	22·16	59·77
290	58	26·46	71·40	341·3	921·0	21·31	57·49
280	56	25·62	69·11	327·9	884·7	20·47	55·23
270	54	24·78	66·86	314·7	849·2	19·65	53·01
260	52	23·93	64·59	301·5	813·2	18·82	50·77
250	50	23·08	62·15	288·5	778·5	18·01	48·60
240	48	22·21	59·94	275·4	743·0	17·19	46·38
230	46	21·33	57·55	262·3	707·8	16·37	44·19
220	44	20·47	55·29	249·7	673·8	15·59	42·06
210	42	19·61	52·91	237·3	640·3	14·81	39·97
200	40	18·76	50·62	225·1	607·4	14·05	37·92
190	38	17·90	48·31	214·0	577·5	13·36	36·05
180	36	17·04	45·97	201·1	542·6	12·55	33·87
170	34	16·18	43·38	189·3	510·9	11·82	31·89
160	32	15·32	41·34	177·7	479·5	11·09	29·93
150	30	14·47	39·04	164·4	449·0	10·26	28·03
140	28	13·62	36·75	155·3	419·0	9·69	26·16

B.

Specific Gravity at 30°.	Degrees Baumé.	Percentage by Weight of		Each Litre contains in grms.		Each Foot Cube contains in pounds	
		Na_2CO_3.	$Na_2CO_3+10H_2O$.	Na_2CO_3.	$Na_2CO_3+10H_2O$.	Na_2CO_3.	$Na_2CO_3+10H_2O$.
1·308	34	27·97	75·48	365·9	987·4	22·84	61·64
297	33	27·06	73·02	351·0	947·1	21·91	59·12
285	32	26·04	70·28	334·6	902·8	20·89	56·36
274	31	25·11	67·76	319·9	863·2	19·97	53·89
263	30	24·18	65·24	305·4	824·1	19·07	51·45
252	29	23·25	62·73	291·1	785·4	18·17	49·03
241	28	22·29	60·15	276·6	746·3	17·27	46·59
231	27	21·42	57·80	263·7	711·5	16·46	44·42
220	26	20·47	55·29	249·7	673·8	15·59	42·06
210	25	19·61	52·91	237·3	640·3	14·81	39·97
200	24	18·76	50·62	225·1	607·4	14·05	37·92
190	23	17·90	48·31	214·0	577·5	13·36	36·05
180	22	17·04	45·97	201·1	542·6	12·55	33·87
171	21	16·27	43·89	190·5	514·0	11·89	32·09
162	20	15·49	41·79	180·0	485·7	11·24	30·32
152	19	14·64	39·51	168·7	455·2	10·53	28·42
142	18	13·79	37·21	157·5	425·0	9·83	26·53

TABLE LXXIIc.—*continued.*

15. Specific Gravity, etc., of Potassium Carbonate Solutions at 15° C. (Gerlach.)

Specific Gravity.	Percentage of K_2CO_3.	Specific Gravity.	Percentage of K_2CO_3.	Specific Gravity.	Percentage of K_2CO_3.
1·00914	1	1·18265	19	1·38279	37
01829	2	19286	20	39476	38
02743	3	20344	21	40673	39
03658	4	21402	22	41870	40
04572	5	22459	23	43104	41
05513	6	23517	24	44388	42
06454	7	24575	25	45573	43
07396	8	25681	26	46807	44
08337	9	26787	27	48041	45
09278	10	27893	28	49314	46
10528	11	28999	29	50588	47
11238	12	30105	30	51861	48
12219	13	31261	31	53135	49
13199	14	32417	32	54408	50
14179	15	33573	33	55728	51
15200	16	34729	34	57048	52
16222	17	35885	35	57079	52·024
17243	18	37082	36		

16. Kohlrausch gives the following for K_2CO_3 solutions at 15° C.:—

Percent. K_2CO_3.	Sp. Gr.	Percent. K_2CO_3.	Sp. Gr.
5	1·0449	30	1·3002
10	0919	40	4172
20	1920	50	5428

TABLE LXXIIc.—*continued.*

17. Specific Gravity, etc., of Solutions of Potashes at 15° C. (Lunge.)

Specific Gravity.	Degrees Baumé.	Degrees Twaddell.	Percentage of K_2CO_3.	Kilogrammes of K_2CO_3 in each Metre Cube of Liquid.	Pounds of K_2CO_3 in each Foot Cube of Liquid.	Specific Gravity.	Degrees Baumé.	Degrees Twaddell.	Percentage of K_2CO_3.	Kilogrammes of K_2CO_3 in each Metre Cube of Liquid.	Pounds of K_2CO_3 in each Foot Cube of Liquid.
1·007	1	1·4	0 7	7	0·44	1·231	27	46·2	23·5	289	18·04
014	2	2·8	1·5	15	0·94	241	28	48·2	24·5	304	18·98
022	3	4·4	2·3	23	1·44	252	29	50·4	25·5	319	19·91
029	4	5·8	3·1	32	2·00	263	30	52·6	26·6	336	20·98
037	5	7·4	4·0	41	2·56	274	31	54·8	27·5	350	21·85
045	6	9·0	4·9	51	3·18	285	32	57·0	28·5	366	22·85
052	7	10·4	5·7	60	3·75	297	33	59·4	29 6	384	23·97
060	8	12·0	6·5	69	4·31	308	34	61·6	30·7	402	25·10
067	9	13·4	7·3	78	4·87	320	35	64·0	31·6	417	26·03
075	10	15·0	8·1	87	5·43	332	36	66·4	32·7	436	27·22
083	11	16·6	9·0	97	6·06	345	37	69·0	33·8	455	28·40
091	12	19·2	9·8	107	6·78	357	38	71·4	34·8	472	29·47
100	13	20·0	10·7	118	7·37	370	39	74·0	35·9	492	30·71
108	14	21·6	11·6	129	8·05	383	40	76·6	37·0	512	31·96
116	15	23·2	12·4	138	8·61	397	41	79·4	38·2	534	33·33
25	16	25·0	13·3	150	9·36	410	42	82·0	39·3	554	34·58
134	17	26·8	14·2	161	10·06	424	43	84·8	40·5	577	36·02
142	18	28·4	15·0	171	10·67	438	44	87·6	41·7	600	37·46
152	19	30·4	16·0	184	11·49	453	45	90·6	42·8	622	38·83
162	20	32·4	17·0	198	12·36	468	46	93·6	44·0	646	40·33
172	21	34·4	18·0	211	13·17	483	47	96·6	45·2	670	41·83
180	22	36·0	18·8	220	13·73	498	48	99·6	46·5	697	43·51
190	23	38·0	19·7	234	14·61	514	49	102·8	47·7	722	45·07
200	24	40·0	20·7	248	15·23	530	50	106·0	48·9	748	46·70
210	25	42·0	21·6	261	16·29	546	51	109·2	50·1	775	48·38
220	26	44·0	22·5	275	17·17	563	52	112·6	51·3	802	50·07

TABLE LXXIIc.—*continued.*

18. Specific Gravity, etc., of Potassium Carbonate Solutions at 17°·5 C. (Hager.)

Sp. Gr.	Per cent. of K_2CO_3.	Sp. Gr.	Per cent. of K_2CO_3.	Sp. Gr.	Per cent. of K_2CO_3.	Sp. Gr.	Per cent. of K_2CO_3.	Sp. Gr.	Per cent. of K_2CO_3.
1·009	1	1·122	13	1·245	25	1·380	37	1·529	49
018	2	132	14	256	26	392	38	542	50
027	3	141	15	267	27	404	39	555	51
036	4	151	16	278	28	416	40	569	52
045	5	161	17	289	29	429	41		
054	6	172	18	300	30	441	42		
064	7	182	19	312	31	453	43		
073	8	192	20	323	32	466	44		
082	9	203	21	334	33	478	45		
092	10	213	22	345	34	489	46		
102	11	224	23	357	35	503	47		
112	12	235	24	368	36	516	48		

19. Density, etc., of Hydrochloric Acid Solutions at 15° C. (Ure.)

Specific Gravity.	Percentage of HCl.	Percentage of Cl.	Specific Gravity.	Percentage of HCl.	Percentage of Cl.
1·2000	40·777	39·675	1·1721	34·660	33·724
1982	40·369	39·278	1701	34·252	33·328
1964	39·961	38·882	1681	33·845	32·931
1946	39·554	38·485	1661	33·437	32·535
1928	39·146	38·089	1641	33·029	32·136
1910	38·738	37·692	1620	32·621	31·746
1893	38·330	37·296	1599	32·213	31·343
1875	37·923	36·900	1578	31·815	30·946
1857	37·516	36·503	1557	31·398	30·550
1846	37·108	36·107	1537	30·990	30·153
1822	37·100	35·707	1515	30·582	29·757
1802	36·292	35·310	1494	30·174	29·361
1782	35·884	34·913	1473	29·767	28·994
1762	35·476	34·517	1452	29·359	28·567
1741	35·068	34·121	1431	28·951	28·171

TABLE LXXIIc.—*continued.*

19. Density, etc., of Hydrochloric Acid Solutions at 15° C.—*continued.*

Specific Gravity.	Percentage of HCl.	Percentage of Cl.	Specific Gravity.	Percentage of HCl.	Percentage of Cl.
1·1410	28·544	27·772	1·0697	14·271	13·887
1389	28·136	27·376	0677	13·863	13·490
1369	27·728	26·979	0657	13·456	13·094
1349	27·321	26·583	0637	13·049	12·697
1328	26·913	26·186	0617	12·641	12·300
1308	26·505	25·789	0597	12·233	11·903
1287	26·098	25·392	0577	11·825	11·506
1267	25·690	24·996	0557	11·418	11·109
1247	25·282	24·599	0537	11·010	10·712
1226	24·874	24·202	0517	10·602	10·316
1206	24·466	23·805	0497	10·194	9·919
1185	24·058	23·408	0477	9·786	9·522
1164	23·650	23·012	0457	9·379	9·126
1143	23·242	22·615	0437	8·971	8·729
1123	22·834	22·218	0417	8·563	8·332
1102	22·426	21·882	0397	8·155	7·935
1082	22·019	21·425	0377	7·747	7·538
1061	21·611	21·028	0357	7·340	7·141
1041	21·203	20·632	0337	6·932	6·745
1020	20·796	20·235	0318	6·524	6·348
1000	20·388	19·837	0298	6·116	5·951
0980	19·980	19·440	0279	5·709	5·554
0960	19·572	19·044	0259	5·301	5·158
0939	19·165	18·647	0239	4·893	4·762
0919	18·757	18·250	0220	4·486	4·365
0899	18·349	17·854	0200	4·078	3·968
0879	17·941	17·457	0180	3·670	3·571
0859	17·534	17·060	0160	3·262	3·174
0838	17·126	16·664	0140	2·854	2·778
0818	16·718	16·267	0120	2·447	2·381
0798	16·310	15·870	0100	2·039	1·984
0778	15·902	15·474	0080	1·631	1·588
0758	15·494	15·077	0060	1·124	1·191
0738	15·087	14·680	0040	0·816	0·795
0718	14·679	14·284	0020	0·408	0·397

TABLE LXXIIc.—*continued.*

20. Specific Gravity, etc., of Solutions of Hydrochloric Acid. (Kolbe.)

Degrees Baumé.	Density.	100 Parts Solution at 0° C. contain of HCl.	At 15° C. 100 Parts of the Solution contain			
			HCl.	Acid of 20° B.	Acid of 21° B.	Acid of 22° B.
0	1·000	0·0	0·1	0·3	0·3	0·3
1	007	1·4	1·5	4·7	4·4	4·2
2	014	2·7	2·9	9·0	8·6	8·1
3	022	4·2	4·5	14·1	13·3	12·6
4	029	5·5	5·8	18·1	17·1	16·2
5	036	6·9	7·3	22·8	21·5	20·4
6	044	8·4	8·9	27·8	26·2	24·4
7	052	9·9	10·4	32·6	30·7	29·1
8	060	11·4	12·0	37·6	35·4	33·6
9	067	12·7	13·4	41·9	39·5	37·5
10	075	14·2	15·0	46·9	44·2	42·0
11	083	15·7	16·5	51 6	48·7	46·2
12	091	17·2	18·1	56·7	53·4	50·7
13	100	18·9	19·9	62·3	58·7	55·7
14	108	20·4	21·5	67·3	63·4	60·2
15	116	21·9	23·1	72·3	68·1	64·7
16	125	23·6	24·8	77·6	73·2	69·4
17	134	25·2	26·6	83·3	78·5	74·5
18	143	27·0	28·4	88·9	83·0	79·5
19	152	28·7	30·2	94·5	89·0	84·6
19·5	157	29·7	31·2	97·7	92·0	87·4
20	161	30·4	32 0	100·0	94·4	89·6
20·5	166	31·4	33·0	103·3	97·3	92·4
21	171	32·3	33·9	106·1	100·0	94·9
21·5	175	33·0	34·7	108·6	102·4	97·2
22	180	34·1	35·7	111·7	105·3	100·0
22·5	185	35·1	36·8	115·2	108·6	103·0
23	190	36·1	37·9	118·6	111·8	106·1
23·5	195	37·1	39·0	122·0	115·0	109·2
24	199	38·0	39·8	124·6	117·4	111·4
24·5	205	39·1	41·2	130·0	121·5	115·4
25	210	40·2	42·4	132·7	125·0	119·0
25·5	212	41·7	42·9	134·3	126·6	120·1

TABLE LXXIIc.—*continued.*

21. Hydrochloric Acid.

Specific Gravity of Hydrochloric Acid at 15° C. compared with water at 4° and reduced to Vacuum. (Lunge and Marchlewski.)

Degrees Twaddell.	Sp. Gr. at $\frac{15°}{4°}$ *in vacuo.*	100 Parts by Weight correspond to Parts by Weight of— HCl.	Acid of Sp. Gr. 1·1425 =28°·5 Tw.	Acid of Sp. Gr. 1·152 =30°·4 Tw.	1 Litre contains Grms. HCl.	1 Cub. Foot contains lbs. of HCl.
0	1·000	0·16	0·57	0·53	1·6	0·10
1	005	1·15	4·08	3·84	12	0·75
2	010	2·14	7·60	7·14	22	1·37
3	015	3·12	11·80	10·41	32	1·99
4	020	4·13	14·67	13·79	42	2·62
5	025	5·15	18·30	17·19	53	3·30
6	030	6·15	21·85	20·53	64	3·99
7	035	7·15	25·40	23·87	74	4·61
8	040	8·16	28·99	27·24	85	5·30
9	045	9·16	32·55	30·58	96	5·98
10	050	10·17	36·14	33·95	107	6·67
11	055	11·18	39·73	37·33	118	7·35
12	060	12·19	43·32	40·70	129	8·04
13	065	13·19	46·87	44·04	141	8·79
14	070	14·17	50·35	47·31	152	9·48
15	075	15·16	53·87	50·62	163	10·16
16	080	16·15	57·39	53·92	174	10·85
17	085	17·13	60·87	57·19	186	11·59
18	090	18·11	64·35	60·47	197	12·28
19	095	19·06	67·73	63·64	209	13·03
20	100	20·01	71·11	66·81	220	13·71
21	105	20·97	74·52	70·01	232	14·46
22	110	21·92	77·89	73·19	243	15·15
23	115	22·86	81·23	76·32	255	15·90
24	120	23·82	84·64	79·53	267	16·65
25	125	24·78	88·06	82·74	278	17·33
26	130	25·75	91·50	85·97	291	18·14
27	135	26·70	94·88	89·15	303	18·89
28	140	27·66	98·29	92·35	315	19·64
29	145	28·61	101·67	95·52	328	20·45
30	150	29·57	105·08	98·73	340	21·20
31	155	30·55	108·58	102·00	353	22·01
32	160	31·52	112·01	105·24	366	22·82
33	165	32·49	115·46	108·48	379	23·63
34	170	33·46	118·91	111·71	392	24·44
35	175	34·42	122·32	114·92	404	25·19
36	180	35·39	125·76	118·16	418	26·06
37	185	36·31	129·03	121·23	430	26·81
38	190	37·23	132·30	124·30	443	27·62
39	195	38·16	135·61	127·41	456	28·43
40	200	39·11	138·98	130·58	469	29·24

TABLE LXXIIc.—*continued.*

22. Influence of Temperature on the Specific Gravity of Hydrochloric Acid.

0° C.	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°	75°	80°	85°	90°	95°	100°
1·168	1·165	1·163	1·160	1·157	1·154	1·152	1·149	1·147	1·144	1·142	1·140	1·138	1·136	1·133	1·131	1·129	1·127	1·125	1·123	1·121
158	155	153	150	147	145	142	139	137	134	132	130	128	126	123	121	119	116	114	112	110
148	145	143	140	137	134	132	129	127	125	123	120	118	116	113	111	108	106	104	102	099
138	135	133	130	127	125	122	119	117	114	112	109	107	104	102	100	097	095	093	090	088
128	125	123	120	117	115	112	110	108	106	103	101	099	096	094	091	089	086	084	081	079
118	115	113	110	107	105	103	101	099	097	094	093	090	088	085	083	080	078	075	073	070
108	105	103	100	097	095	092	090	088	086	084	082	080	078	076	073	071	069	066	064	061
098	095	093	090	087	085	082	080	077	075	073	071	069	067	065	063	061	059	057	055	053
088	085	083	080	077	075	073	070	068	066	064	062	060	058	056	054	053	051	049	047	045
078	075	073	070	068	066	063	061	059	057	055	053	051	049	048	046	044	043	041	039	037
068	065	063	060	058	055	053	050	048	046	044	042	040	038	036	034	033	031	029	027	025
058	055	053	050	048	045	043	040	038	035	033	031	029	027	025	023	021	019	017	015	013
048	045	043	040	037	035	032	030	027	025	022	020	018	016	014	011	009	007	005	003	001
038	035	033	030	027	024	022	019	017	014	012	010	008	005	003	001	0·999	0·997	0·995	0·993	0·991
028	025	023	020	017	014	012	009	007	004	002	000	0·998	0·995	0·993	0·991	989	987	985	983	981
018	015	013	010	007	004	002	0·999	0·997	0·994	0·992	0·990	988	985	983	981	979	977	975	973	971

TABLE LXXIIc.—*continued.*

23.—Specific Gravity, etc., of Hydrobromic Acid Solutions at 15° C. (Wright.)

Specific Gravity.	Percentage of HBr.	Specific Gravity.	Percentage of HBr.	Specific Gravity.	Percentage of HBr.
1·000	0	1·159	20	1·365	40
038	5	204	25	435	45
077	10	252	30	515	50
177	15	305	35		

24.—Specific Gravity, etc., of Hydrobromic Acid Solutions at 14° C. (Gerlach, from Töpsoe +.)

Specific Gravity.	Weight of HBr. in		Specific Gravity.	Weight of HBr. in		Specific Gravity.	Weight of HBr. in	
	100 parts by weight.	1 litre of solution.		100 parts by weight.	1 litre of solution.		100 parts by weight.	1 litre of solution.
		Grms.			Grms.			Grms.
1·007	1	10·009	1·140	18	203·764	1·314	35	456·681
014	2	20·138	149	19	216·972	326	36	474·018
021	3	30·416	158	20	229·979	338	37	491·004
028	4	40·832	167	21	243·376	351	38	509·786
035	5	51·388	176	22	256·909	363	39	527·849
043	6	62·142	186	23	270·871	376	40	546·547
050	7	72·986	196	24	285·031	389	41	565·504
058	8	84·048	206	25	299·390	403	42	585·135
065	9	95·179	215	26	313·689	417	43	605·045
073	10	106·549	225	27	328·435	431	44	625·233
081	11	118·078	235	28	343·379	445	45	645·698
089	12	129·765	246	29	358·811	459	46	666·442
097	13	141·612	257	30	374·460	473	47	687·464
106	14	153·756	268	31	390·328	487	48	708·764
114	15	165·930	279	32	406·415	502	49	730·828
122	16	178·263	290	33	422·720			
131	17	190·924	302	34	439·581			

TABLE LXXIIc.—*continued.*

24.*—Specific Gravity, etc., of Hydrogen Bromide Solutions at 15° C. (Biel.)

Percentage of HBr.	Specific Gravity.	Percentage of HBr.	Specific Gravity.	Percentage of HBr.	Specific Gravity.
1	1·0082	18	1·145	35	1·314
2	0155	19	154	36	326
3	0230	20	163	37	338
4	0305	21	172	38	350
5	038	22	181	39	362
6	046	23	190	40	375
7	053	24	200	41	388
8	061	25	209	42	401
9	069	26	219	43	415
10	077	27	229	44	429
11	085	28	239	45	444
12	093	29	249	46	459
13	102	30	260	47	474
14	110	31	270	48	490
15	119	32	281	49	496
16	127	33	292	50	513
17	136	34	303		

25.—Specific Gravity, etc., of Hydriodic Acid Solutions at 15° C. (Wright.)

Specific Gravity.	Percentage of HI.	Specific Gravity.	Percentage of HI.	Specific Gravity.	Percentage of HI.
1·000	0	1·187	20	1·438	40
045	5	239	25	533	45
091	10	296	30	650	50
138	15	361	35	700	52

TABLE LXXIIc.—*continued.*

26.—Specific Gravity, etc., of Hydriodic Acid Solutions at 13° C. (Gerlach, from Töpsoe +.)

Specific Gravity.	Weight of HI in 100 parts by weight of solution.	Weight of HI in 1 litre of solution.	Specific Gravity.	Weight of HI in 100 parts by weight of solution.	Weight of HI in 1 litre of solution.	Specific Gravity.	Weight of HI in 100 parts by weight of solution.	Weight of HI in 1 litre of solution.
		Grms.			Grms.			Grms.
1·008	1	10·074	1·175	21	246·610	1·414	41	579·410
015	2	20·288	185	22	260·552	429	42	599·839
022	3	30·643	195	23	274·694	444	43	620·567
029	4	41·137	205	24	289·036	459	44	641·595
037	5	51·821	216	25	303·827	475	45	663·372
045	6	62·664	227	26	318·839	491	46	685·470
053	7	73·668	238	27	334·070	508	47	708·357
061	8	84·832	249	28	349·521	525	48	731·684
069	9	96·155	260	29	365·192	543	49	755·640
077	10	107·639	271	30	381·083	561	50	780·057
085	11	119·282	283	31	397·504	579	51	804·833
093	12	131·085	295	32	414·164	597	52	829·968
102	13	143·178	307	33	431·064	615	53	855·463
110	14	155·312	320	34	448·545	634	54	881·858
118	15	167·605	333	35	466·295	654	55	909·183
127	16	180·217	346	36	484·284	674	56	936·907
137	17	193·180	359	37	502·544	694	57	965·031
146	18	206·163	372	38	521·063	713	58	992·975
155	19	219·325	386	39	540·232			
165	20	232·868	400	40	559·681			

Töpsoe's numbers, from which the preceding tables have been calculated, were as follows :—

27. For Hydrobromic Acid.

Temperature.	Specific Gravity.	Percentage HBr.	Temperature.	Specific Gravity.	Percentage HBr.	Temperature.	Specific Gravity.	Percentage HBr.
14° C.	1·055	7·67	13° C.	1·200	24·35	13° C.	1·419	43·12
14	075	10·19	13	232	27·62	13	431	43·99
14	089	11·94	13	253	29·68	13	438	44·62
14	097	12·96	13	302	33·84	14	451	45·45
14	118	15·37	13	335	36·67	13	460	46·09
14	131	16·92	13	349	37·86	14	485	47·87
14	164	20·65	13	368	39·13	14	490	48·17

TABLE LXXIIc.—*continued.*

28. For Hydriodic Acid.

Temperature.	Specific Gravity.	Percentage HI.	Temperature.	Specific Gravity.	Percentage HI.	Temperature.	Specific Gravity.	Percentage HI.
13·5	1·017	2·29	13·5	1·254	28·41	13·5	1·542	49·13
13·5	052	7·02	13·5	274	30·20	13	573	50·75
13·5	077	10·15	13	309	33·07	12·5	603	52·43
13	095	12·21	13	347	36·07	14	630	53·93
13.5	102	13·09	13	382	38·68	13·7	674	56·15
13·5	126	15·73	13	413	40·43	13	696	57·28
13·5	164	19·97	13	451	43·39	12·5	703	57·42
13·8	191	22·63	13	487	45·71	13·7	706	57·64
13·8	225	25·86	13	528	48·22	12	708	57·74

29. Specific Gravity, etc., of Nitric Acid Solutions at 15° C.

Specific Gravity.	Degrees Baumé.	Composition.	Percentage of Water.	Percentage of HNO_3.	Percentage of N_2O_5.	Boiling Point.
1·522	49·3	HNO_3		100·00	85·8	86° C.
486	46·5	$+ \frac{1}{2}H_2O$	11·25	88·75	75·1	99
452	45	H_2O	22·22	77·78	66·7	115
420	42·6	$1\frac{1}{2}H_2O$	30·00	70·00	60·1	123
390	40·40	$2\ H_2O$	36·36	62·64	54·5	119
361	38·20	$2\frac{1}{2}H_2O$	41·67	58·33	50·1	117
338	36·5	$3\ H_2O$	46·16	53·84	46·2	
315	34·5	$3\frac{1}{2}H_2O$	50·00	50·00	42·9	113
297	33·2	$4\ H_2O$	53·33	46·67	40·1	
277	31·4	$4\frac{1}{2}H_2O$	56·25	43·75	37·6	
260	29·7	$5\ H_2O$	58·82	41·18	35·4	
245	28·4	$5\frac{1}{2}H_2O$	61·11	38·89	33·4	
232	27·2	$6\ H_2O$	63·16	36·84	31·6	
219	25·8	$6\frac{1}{2}H_2O$	65·00	35·00	30·1	
207	24·7	$7\ H_2O$	66·67	33·33	28·6	108
197	23·8	$7\frac{1}{2}H_2O$	68·18	31·82	27·3	
188	22·9	$8\ H_2O$	69·56	30·44	26·1	
180	22·0	$8\frac{1}{2}H_2O$	70·83	29·17	25·0	
173	21·9	$9\ H_2O$	72·00	28·00	24·0	
166	20·4	$9\frac{1}{2}H_2O$	73·08	26·92	23·1	
160	19·9	$10\ H_2O$	74·07	25·93	22·2	
155	19·3	$10\frac{1}{2}H_2O$	75·00	25·00	21·4	about 104°

TABLE LXXIIc.—*continued*

30. Specific Gravity, etc., of Nitric Acid Solutions at 0° and 15° C. (Kolb.)

Percentage of HNO_3.	Specific Gravity at 0° C.	Specific Gravity at 15° C.	Contraction.	Percentage of HNO_3.	Specific Gravity at 0° C.	Specific Gravity at 15° C.	Contraction
100·00	1·559	1·530	0·0000	58·88	1·387	1·368	0·0861
99·84	559	530	004	58·00	382	363	864
99·72	558	530	010	57·00	376	358	868
99·52	557	529	014	56·10	371	353	870
97·89	551	523	065	55·00	365	346	874
97·00	548	520	090	54·00	359	341	875
96·00	544	516	120	53·81	358	339	875
95·27	542	514	142	53·00	353	335	875
94·00	537	509	182	52·33	349	331	875
93·01	533	506	208	50·99	341	323	872
92·00	529	503	242	49·97	334	317	867
91·00	526	499	272	49·00	328	312	862
90·00	522	495	301	48·00	321	304	856
89·56	521	494	315	47·18	315	298	850
88·00	514	488	354	46·64	312	295	848
87·45	513	486	369	45·00	300	284	835
86·17	507	482	404	43·53	291	274	820
85·00	503	478	433	42·00	280	261	808
84·00	499	474	459	41·00	274	257	796
83·00	495	470	485	40·00	267	251	786
82·00	492	467	508	39·00	260	244	775
80·96	488	463	531	37·95	253	237	762
80·00	484	460	556	36·00	240	225	740
79·00	481	456	580	35·00	234	218	729
77·66	476	451	610	33·86	226	211	718
76·00	469	445	643	32·00	214	198	692
75·00	465	442	666	31·00	207	192	678
74·01	462	438	688	30·00	200	185	664
73·00	457	435	708	29·00	194	179	650
72·39	455	432	722	28·00	187	172	635
71·24	450	429	740	27·00	180	166	616
69·96	444	423	760	25·71	171	157	593
69·20	441	419	771	23·00	153	138	520
68·00	435	414	784	20·00	132	120	483
67·00	430	410	796	17·47	115	105	422
66·00	425	405	806	15·00	099	089	336
65·07	420	400	818	13·00	085	077	316
64·00	415	395	830	11·41	075	067	296
63·59	413	393	833	7·72	050	045	206
62·00	404	386	846	4·00	026	022	112
61·21	400	381	850	2·00	013	010	055
60·00	393	374	854	0·00	000	0·999	000
59·59	391	372	855				

TABLE LXXIIc.—*continued.*

31. Nitric Acid. Lunge and Rey. (English Weights by J. C.-E.)

Specific Gravity $\frac{15°}{4°}$	Degrees Baumé.	100 parts by weight contain		Kilogrammes per Litre of		Pounds per Cubic Foot.			Pounds per Gallon.		
		N_2O_5.	HNO_3.	N_2O_5.	HNO_3.	Total.	N_2O_5.	HNO_3.	Total.	N_2O_5.	HNO_3.
1·000	0·0	0·08	0·10	0·001	0·001	62·427	0·0535	0·0624	10·011	0·0086	0·010
005	0·7	0·85	1·00	008	010	62·739	0·5378	0·6274	061	086	101
010	1·4	1·62	1·90	016	019	63·051	1·0269	1·1980	111	165	192
015	2·1	2·39	2·80	024	028	63·363	1·5208	1·7742	161	244	285
020	2·7	3·17	3·70	033	038	63·676	2·0110	2·3560	211	324	378
025	3·4	3·94	4·60	040	047	63·988	2·5231	2·9434	261	405	472
030	4·1	4·71	5·50	049	057	64·300	3·0315	3·5365	311	486	567
035	4·7	5·47	6·38	057	066	64·612	3·5336	4·1222	361	568	661
040	5·4	6·22	7·26	064	075	64·924	4·0404	4·7135	412	648	756
045	6·0	6·97	8·13	073	085	65·236	4·5464	5·3037	462	729	851
050	6·7	7·71	8·99	081	094	65·548	5·0541	5·8960	512	810	945
055	7·4	8·43	9·84	089	104	65·861	5·5553	6·4807	562	891	1·039
060	8·0	9·15	10·68	097	113	66·173	6·0581	7·0672	612	972	133
065	8·7	9·87	11·51	105	123	66·485	6·5597	7·6524	662	1·052	227
070	9·4	10·57	12·33	113	132	66·797	7·0600	8·2361	712	132	321
075	10·0	11·27	13·15	121	141	67·109	7·5648	8·8248	762	213	415
080	10·6	11·96	13·95	129	151	67·421	8·0623	9·4053	812	293	508
085	11·2	12·64	14·74	137	160	67·733	8·5603	9·9839	862	373	601
090	11·9	13·31	15·53	145	169	68·045	9·0585	10·5675	912	453	695
095	12·4	13·99	16·32	153	179	68·358	9·5630	11·1560	962	534	789
100	13·0	14·67	17·11	161	188	68·670	10·0717	11·7494	11·012	615	884
105	13·6	15·34	17·89	170	198	68·982	10·5787	12·3409	062	696	979
110	14·2	16·00	18·67	177	207	69·294	11·0899	12·9372	112	778	2·075
115	14·9	16·67	19·45	186	217	69·606	11·6053	13·5384	162	861	171
120	15·4	17·34	20·23	195	227	69·918	12·1248	14·1445	212	944	268
125	16·0	18·00	21·00	202	236	70·230	12·6425	14·7484	262	2·028	365
130	16·5	18·66	21·77	211	246	70·543	13·1643	15·3571	313	111	463
135	17·1	19·32	22·54	219	256	70·854	13·6902	15·9707	363	195	561
140	17·7	19·98	23·31	228	266	71·167	14·2203	16·5890	413	280	660
145	18·3	20·64	24·08	237	276	71·479	14·7544	17·2121	463	366	760

31. Nitric Acid—*continued.*

Specific Gravity $\frac{15^\circ}{4^\circ}$	Degrees Baumé.	100 parts by weight contain		Kilogrammes per Litre of		Pounds per Cubic Foot.			Pounds per Gallon.		
		N_2O_5.	HNO_3.	N_2O_5.	HNO_3.	Total.	N_2O_5.	HNO_3.	Total.	N_2O_5.	HNO_3.
1·150	18·8	21·29	24·84	0·245	0·286	71·791	15·2866	17·8329	11·513	2·451	2·860
155	19·3	21·94	25·60	254	296	72·103	15·8228	18·4584	563	537	960
160	19·8	22·60	26·36	262	306	72·415	16·3630	19·0887	613	624	3·061
165	20·3	23·25	27·12	271	316	72·728	16·9074	19·7237	663	711	163
170	20·9	23·90	27·88	279	326	73·040	17·4548	20·3635	713	799	266
175	21·4	24·54	28·63	288	336	73·352	18·0020	21·0006	763	887	368
180	22·0	25·18	29·38	297	347	73·664	18·5522	21·6425	813	975	471
185	22·5	25·83	30·13	306	357	73·976	19·1064	22·2890	863	3 064	574
190	23·0	26·47	30·88	315	367	74·288	19·6644	22·9402	913	153	679
195	23·5	27·10	31·62	324	378	74·600	20·2202	23·5886	963	242	783
200	24·0	27·74	32·36	333	388	74·912	20·7800	24·2417	12·013	332	888
205	24·5	28·36	33·09	342	399	75·225	21·3373	24·8918	063	422	992
210	25·0	28·99	33·82	351	409	75·537	21·8985	25·5465	113	512	4·097
215	25·5	29·61	34·55	360	420	75·849	22·4636	26·2058	163	602	202
220	26·0	30·24	35·28	369	430	76·161	23·0327	26·8696	213	693	309
225	26·4	30·88	36·03	378	441	76 473	23·6187	27·5533	264	787	419
230	26·9	31·53	36·78	387	452	76·785	24·2088	28·2416	314	882	529
235	27·4	32·17	37·53	397	463	77·097	24·8028	28·9347	364	977	640
240	27·9	32·82	38·29	407	475	77·410	25·4075	29·6401	414	4·074	753
245	28·4	33·47	39·05	417	486	77·721	26·0163	30·3503	464	172	867
250	28·8	34·13	39·82	427	498	78·034	26·6359	31·0731	514	269	981
255	29·3	34·78	40·58	437	509	78·346	27·2528	31·7928	564	369	5·098
260	29·7	35·44	41·34	447	521	78·658	27·8738	32·5173	614	470	215
265	30·2	36·09	42·10	457	533	78·970	28·4989	33·2465	664	571	332
270	30·6	36·75	42·87	467	544	79·282	29·1340	33·9883	714	672	450
275	31·1	37·41	43·64	477	556	79·594	29·7606	34·7350	764	774	569
280	31·5	38·07	44·41	487	568	79·907	30·4194	35·4865	814	877	691
285	32·0	38·73	45·18	498	581	80·219	31·0678	36·2428	864	982	812
290	32·4	39·39	45·95	508	593	80·531	31·7202	37·0039	914	5·087	934

295	32·8	40·05	46·72	519	605	80·843	32·3768	37·7699	964	190	6·055
300	33·3	40·71	47·49	529	617	81·155	33·0374	38·5406	13·014	298	181
305	33·7	41·37	48·26	540	630	81·467	33·7022	39·3161	064	404	305
310	34·2	42·06	49·07	551	643	81·779	34·3992	40·1292	114	516	435
315	34·6	42·76	49·89	562	656	82·092	35·1075	40·9555	165	630	568
320	35·0	43·47	50·71	573	669	82·404	35·8202	41·7869	215	744	701
325	35·4	44·17	51·53	585	683	82·716	36·5373	42·6235	265	859	835
330	35·8	44·89	52·37	597	697	83·028	37·2730	43·4818	315	977	973
3325	36·0	45·26	52·80	603	704	83·184	37·6297	43·9212	340	6·038	7·043
335	36·2	45·62	53·22	609	710	83·340	38·0204	44·3536	365	097	113
340	36·6	46·35	54·07	621	725	83·652	38·7723	45·2308	415	217	253
345	37·0	47·08	54·93	633	739	83·964	39·5360	46·1216	465	341	397
350	37·4	47·82	55·79	645	753	84·277	40·3042	47·0179	515	463	540
355	37·8	48·57	56·66	658	768	84·589	41·0844	47·9279	565	589	686
360	38·2	49·35	57·57	671	783	84·901	41·8981	48·8774	615	719	838
365	38·6	50·13	58·48	684	798	85·213	42·7270	49·8325	665	850	991
370	39·0	50·91	59·39	698	814	85·525	43·5406	50·7933	715	982	8·145
375	39·4	51·69	60·30	711	829	85·837	44·3691	51·7598	765	7·115	300
380	39·8	52·52	61·27	725	846	86·149	45·2468	52·7837	815	255	465
3833	40·0	53·08	61·92	735	857	86·355	45·9361	53·4712	848	350	575
385	40·1	53·35	62·24	739	862	86·461	46·1296	53·8136	865	397	630
390	40·5	54·20	63·23	753	879	86·774	46·8897	54·8670	915	542	799
395	40·8	55·07	64·25	768	896	87·086	47·9632	55·9526	965	692	973
400	41·2	55·97	65·30	783	914	87·398	48·9217	57·0708	14·015	845	9·152
405	41·6	56·92	66·40	800	933	87·710	49·9321	58·2494	066	8·006	340
410	42·0	57·87	67·50	816	952	88·022	50·9311	59·4149	116	167	528
415	42·3	58·83	68·63	832	971	88·334	51·9674	60·6238	166	334	722
420	42·7	59·83	69·80	849	991	88·646	53·0401	61·8752	216	506	923
425	43·1	60·84	70·98	867	1·011	88·959	54·1267	63·1428	266	680	10·126
430	43·4	61·86	72·17	885	032	89·271	55·2272	64·4267	316	856	332
435	43·8	62·91	73·39	903	053	89·583	56·3572	65·7448	366	9·038	544
440	44·1	64·01	74·68	921	075	89·895	57·5476	67·1336	416	229	766
445	44·4	65·13	75·98	941	098	90·207	58·7544	68·5413	466	422	991
450	44·8	66·24	77·28	961	121	90·519	59·9647	69·9533	516	616	11·218
455	45·1	67·38	78·60	981	144	90·831	61·1993	71·3935	566	814	449
460	45·4	68·56	79·98	1·001	168	91·143	65·4877	72·8966	616	10·021	690
465	45·8	69·79	81·42	023	193	91·456	63·8307	74·4632	666	236	941
470	46·1	71·06	82·90	045	219	91·768	65·2128	76·0755	716	458	12·200

TABLE LXXIIc.—*continued.*

31. Nitric Acid—*continued.*

Specific Gravity $\frac{15°}{4°}$	Degrees Baumé.	100 parts by weight contain		Kilogrammes per Litre of		Pounds per Cubic Foot.			Pounds per Gallon.		
		N_2O_5.	HNO_3.	N_2O_5.	HNO_3.	Total.	N_2O_5.	HNO_3.	Total.	N_2O_5.	HNO_3.
1·475	46·4	72·39	84·45	1·068	1·246	92·080	66·6580	77·7615	14·766	10·690	12·470
480	46·8	73·76	86·05	092	274	92·392	68·1511	79·5034	816	929	749
485	47·1	75·18	87·70	116	302	92·704	69·6913	81·3016	866	11·176	13·038
490	47·4	76·80	89·60	144	335	93·016	71·4455	83·3465	916	457	365
495	47·8	78·52	91·60	174	369	93·328	73·2830	85·4889	967	752	709
500	48·1	80·65	94·09	210	411	93·641	75·5258	88·1064	15·017	12·111	14·129
501	...	81·09	94·60	217	420	93·703	76·1287	88·6430	027	185	215
502	...	81·50	95·08	224	428	93·765	76·4222	89·1522	037	255	297
503	...	81·91	95·55	231	436	93·828	76·8511	89·6525	047	324	377
504	...	82·29	96·00	238	444	93·890	77·2644	90·1347	057	391	454
505	48·4	82·63	96·39	244	451	93·953	77·6442	90·5610	067	449	523
506	...	82·94	96·76	249	457	94·015	77·9797	90·9691	077	505	588
507	...	83·26	97·13	255	464	94·078	78·3298	91·3775	087	561	654
508	48·5	83·58	97·50	260	470	94·140	78·6804	91·7865	097	617	719
509	...	83·87	97·84	265	476	94·202	79·0061	92·1677	107	670	780
510	48·7	84·09	98·10	270	481	94·265	79·2696	92·4738	117	712	829
511	...	84·28	98·32	274	486	94·327	79·4999	92·7426	127	751	873
512	...	84·46	98·53	277	490	94·390	79·7225	93·0022	137	785	914
513	...	84·63	98·73	280	494	94·452	79·9372	93·2526	147	819	954
514	...	84·78	98·90	283	497	94·515	80·1277	93·4749	157	850	990
515	49·0	84·92	99·07	287	501	94·577	80·3185	93·6974	167	880	15·026
516	...	85·04	99·21	289	504	94·639	80·4851	93·8918	177	907	057
517	...	85·15	99·34	292	507	94·702	80·6814	94·1208	187	932	087
518	...	85·26	99·46	294	510	94·764	80·7943	94·2525	197	956	115
519	...	85·35	99·57	296	512	94·827	80·9370	94·4189	207	979	141
520	49·4	85·44	99·67	299	515	94·889	81·0716	94·5760	217	13·001	167

TABLE LXXIIc.—*continued.*

32—I. Specific Gravity of Sulphuric Acid at 60° F.

Degrees Twaddell.	100 parts by weight contain		Kilo. per litre H_2SO_4.	1 Cubic Foot of Acid at 60° F.		
	SO_3.	H_2SO_4		weighs lbs. avd.	contains lbs. avd. H_2SO_4.	yields lbs. avd. Na_2SO_4.
40	22·30	27·32	0·328	74·82	20·44	29·62
41	22·82	27·95	337	75·14	21·00	33·43
42	23·33	28·58	346	75·45	21·57	31·25
43	23·84	29·21	355	75·76	22·14	32·08
44	24·36	29·84	364	76·07	22·71	32·90
45	24·88	30·84	373	76·38	23·28	33·73
46	25·39	31·11	382	76·69	23·85	34·55
47	25·88	31·70	391	77·00	24·41	35·37
48	26·35	32·28	400	77·32	24·97	36·18
49	26·83	32·86	409	77·63	25·54	37·01
50	27·29	33·43	418	77·94	26·10	37·82
51	27·76	34·00	426	78·25	26·66	38·63
52	28·22	34·57	435	78·56	27·23	39 45
53	28·69	35·14	444	78·87	27·79	40·27
54	29·15	35·71	454	79·19	28·35	41·08
55	29·62	36·29	462	79·50	28·92	41·90
56	30·10	36·87	472	79·81	29·48	42·72
57	30·57	37·45	481	80·12	30·04	43·53
58	31·04	38·03	490	80·43	30·60	44·34
59	31·52	38·61	500	80·74	31·17	45·16
60	31·99	39·19	510	81·06	31·74	45·99
61	32·46	39·77	519	81·37	32·32	46·83
62	32·94	40·35	529	81·68	32·89	47·65
63	33·41	40·93	538	81·99	33·46	48·48
64	33·88	41·50	548	82·30	34·03	49·31
65	34·35	42·08	557	82·62	34·60	50·13
66	34·80	42·66	567	82·93	35·18	50·98
67	35·27	43·20	577	83·24	35·79	51·86
68	35·71	43·74	586	83·55	36·40	52·74
69	36·14	44·28	596	83·86	37·01	53·63
70	36·58	44·82	605	84·17	37·63	54·52
71	37·02	45·35	614	84·49	38·24	55·41
72	37·45	45·88	624	84·80	38·85	56·29
73	37·89	46·41	633	85·11	39·46	57·18
74	38·32	46·94	643	85·42	40·07	58·05
75	38·75	47·47	653	85·73	40·68	58·94
76	39·18	48·00	662	86·04	41·29	59·83
77	39·62	48·53	672	86·36	41·91	60·72
78	40·05	49·06	682	86·67	42·52	61·61

TABLE LXXIIc.—*continued.*

32—I. Specific Gravity of Sulphuric Acid at 60° F.—*continued.*

Degrees Twaddell.	100 parts by weight contain		Kilo. per litre H_2SO_4.	1 Cubic Foot of Acid at 60° F.		
	SO_3.	H_2SO_4.		weighs lbs. avd.	contains lbs. avd. H_2SO_4.	yields lbs. avd. Na_2SO_4.
79	40·48	49·59	0·692	86·98	43·13	62·50
80	40·91	50·11	702	87·29	43·74	63·38
81	41·33	50·63	711	87·60	44·36	64·27
82	41·76	51·15	721	87·92	44·97	65·13
83	42·17	51·66	730	88·23	45·58	66·02
84	42·57	52·15	740	88·51	46·18	66·90
85	42·96	52·63	750	88·85	46·78	67·78
86	43·36	53·11	759	89·16	47·38	68·65
87	43·75	53·59	769	89·47	47·99	69·53
88	44·14	54·07	779	89·79	48·59	70·41
89	44·53	54·55	789	90·10	49·19	71·28
90	44·92	55·03	798	90·41	49·79	72·15
91	45·31	55·50	808	90·72	50·39	73·01
92	45·69	55·97	817	91·03	50·99	73·88
93	46·07	56·43	827	91·35	51·59	74·76
94	46·45	56·90	837	91·66	52·19	75·62
95	46·83	57·37	846	91·97	52·79	76·49
96	47·21	57·83	856	92·28	53·39	77·36
97	47·57	58·28	866	92·59	54·00	78·25
98	47·95	58·74	876	92·90	54·60	79·12
99	48·34	59·22	886	93·22	55·20	79·98
100	48·73	59·70	896	93·53	55·84	80·92
101	49·12	60·18	906	93·84	56·47	81·82
102	49·51	60·65	916	94·15	57·10	82·74
103	49·89	61·12	926	94·46	57·73	83·65
104	50·28	61·59	936	94·77	58·36	84·56
105	50·66	62·06	946	95·09	59·00	85·50
106	51·04	62·53	957	95·40	59·62	86·39
107	51·43	63·00	967	95·71	60·26	87·32
108	51·78	63·43	977	96·02	60·89	88·23
109	52·12	63·85	987	96·33	61·52	89·15
110	52·46	64·26	996.	96·65	62·15	90·06
111	52·79	64·67	1·006	96·96	62·78	90·97
112	53·12	65·08	015	97·27	63·42	91·90
113	53·46	65·49	025	97·58	64·05	92·81
114	53·80	65·90	035	97·89	64·68	93·72
115	54·13	66·30	044	98·20	65·31	94·64
116	54·46	66·71	054	98·52	65·94	95·54
117	54·80	67·13	064	98·83	66·58	96·48
118	55·18	67·59	075	99·14	67·21	97·40
119	55·55	68·05	085	99·45	67·84	98·30

TABLE LXXIIc.—*continued.*

32—I. Specific Gravity of Sulphuric Acid at 60° F.—*continued.*

Degrees Twaddell.	100 parts by weight contain		Kilo. per litre H_2SO_4.	1 Cubic Foot of Acid at 60° F.		
	SO_3.	H_2SO_4.		weighs lb. avd.	contains lb. avd. H_2SO_4.	yields lb. avd. Na_2SO_4.
120	55·93	68·51	1·096	99·76	68·47	99·22
121	56·30	68·97	107	100·07	69·10	100·15
122	56·68	69·43	118	100·39	69·74	101·05
123	57·05	69·89	128	100·70	70·37	101·95
124	57·40	70·32	139	101·01	71·07	102·96
125	57·75	70·74	150	101·32	71·77	103·00
126	58·09	71·16	160	101·64	72·46	105·00
127	58·43	71·57	170	101·95	73·16	106·00
128	58·77	71·99	181	102·26	73·85	107·00
129	59·10	72·40	192	102·57	74·55	108·00
130	59·45	72·87	202	102·88	75·25	109·05
131	59·78	73·23	212	103·19	75·94	110·04
132	60·11	73·64	222	103·50	76·64	111·05
133	60·46	74·07	233	103·82	77·33	112·05
134	60·82	74·51	244	104·13	78 03	113·05
135	61·20	74·97	256	104·44	78·73	114·10
136	61·57	75·42	267	104·75	79 42	115·10
137	61·93	75·86	278	105·07	80·12	116·10
138	62·29	76·30	289	105·38	80·81	117·10
139	62·64	76·73	301	105·69	81·51	118·10
140	63·00	77·17	312	106 00	82·21	119·15
141	63·35	77·60	323	106·31	82·90	120·15
142	63·70	78·04	334	106·62	83·60	121·15
143	64·07	78·48	346	106·94	84·29	122·15
144	64·43	78·92	357	107·25	84·99	123·15
145	64·78	79·36	369	107·56	85·69	124·20
146	65·14	79·80	381	107·87	86·38	125·20
147	65·50	80·24	392	108·18	87·08	126·20
148	65·86	80·68	404	108·49	87·77	127·20
149	66·22	81·12	416	108·80	88·47	128·20
150	66·58	81·56	427	109·12	89·17	129·20
151	66·94	82·00	439	109·43	89·46	130·20
152	67·30	82·44	451	109·74	90·56	131·20
153	67·65	82·88	463	110·05	91·25	132·25
154	68·02	83·32	475	110·36	91·95	133·25
155	68·49	83·90	489	110·68	92·88	134·60
156	68·98	84·50	504	110·99	93·81	135·90
157	69·47	85·10	519	111·30	94·74	137·30
158	69·96	85·70	534	111·61	95·67	138·50
159	70·45	86·30	549	111·92	96·60	140·00
160	70·94	86·90	564	112·23	97·52	141·30

TABLE LXXIIc.—*continued.*

33—II. Specific Gravity of Highly Concentrated Sulphuric Acid at 60° F.

Degrees Twaddell.	Specific Gravity.	100 parts by weight contain		Kilo. per litre H_2SO_4.
		SO_3.	H_2SO_4.	
160	1·800	70·94	86·90	1·564
161	805	71·50	87·60	581
162	810	72·08	88·30	598
163	815	72·69	89·05	621
164	820	73·51	90·05	639
	821	73·63	90·20	643
	822	73·80	90·40	647
	823	73·96	90·60	651
	824	74·12	90·80	656
165	825	74·29	91·00	661
	826	74·49	91·25	666
	827	74·69	91·50	671
	828	74·86	91·70	676
	829	75·03	91·90	681
166	830	75·19	92·10	685
	831	75·35	92·30	690
	832	75·53	92·52	695
	833	75·72	92·75	700
	834	75·96	93·05	706
167	835	76·27	93·43	713
	836	76·57	93·80	722
	837	76·90	94·20	730
	838	77·23	94·60	739
	839	77·55	95·00	748
168	840	78·04	95·60	759
	8405	78·33	95·95	765
	8410	79·19	97·00	786
	8415	79·76	97·70	799
	8410	80·16	98·20	808
	8405	80·57	98·70	816
	8400	80·98	99·20	825
	8395	81·18	99·45	830
	8390	81·39	99·70	834
	8385	81·59	99·95	838

TABLE LXXIIc.—*continued.*

34—III. Specific Gravities and Percentage of Fuming (Nordhausen) Oil of Vitriol at different Temperatures.

Density at					SO_3 per cent.
15° C.	20°	25°	30°	35°	
1·8417	1·8371	1·8323	1·8287	1·8240	76·67
8427	8378	8333	8295	8249	77·49
8428	8388	8351	8302	8255	78·34
8437	8390	8346	8300	8257	79·04
8427	8386	8351	8297	8250	79·99
8420	8372	8326	8281	8234	80·46
8398	8350	8305	8263	8218	80·94
8446	8400	8353	8307	8262	81·37
8509	8466	8418	8371	8324	81·91
8571	8522	8476	8432	8385	82·17
8697	8647	8595	8545	8498	82·94
8790	8742	8687	8640	8592	83·25
8875	8823	8767	8713	8661	83·84
8942	8888	8833	8775	8722	84·12
8990	8940	8890	8830	8772	84·83
9034	8984	8930	8874	8820	84·67
9072	9021	8950	8900	8845	84·82
9095	9042	8986	8932	8866	84·99
9121	9053	8993	8948	8892	85·14
9250	9193	9135	9082	9023	85·54
9290	9236	9183	9129	9073	85·68
9368	9310	9250	9187	9122	85·88
9447	9392	9334	9279	9222	86·51
9520	9465	9402	9338	9278	86·72
9584	9528	9466	9406	9340	87·03
9632	9573	9518	9457	9398	87·46
cryst.	cryst.	9740	9666	9740	88·00

TABLE LXXIIc.—*continued.*

34—IV. Specific Gravities, etc., of Sulphuric Acid. (Lunge and Isler. English Weights, etc., by J. C.-E.)

Specific Gravity $\frac{15^\circ}{4^\circ}$ in vacuo.	Degrees Baumé.	Degrees Twaddell.	100 parts by weight contain		Kilogrammes per Litre.		Pounds per Foot Cube.			Pounds per Gallon.		
			SO_3.	H_2SO_4.	SO_3.	H_2SO_4.	Total.	SO_3.	H_2SO_4.	Total.	SO_3.	H_2SO_4.
1·000	0·0	0	0·07	0·09	0·001	0·001	62·427	0·0439	0·0534	10·011	0·0070	0·0085
005	0·7	1	0·68	0·83	007	008	62·739	0·4266	0·5225	061	0684	0837
010	1·4	2	1·28	1·57	013	016	63·051	0·8070	0·9886	111	1294	1585
015	2·1	3	1·88	2·30	019	023	63·363	1·1912	1·4592	161	1910	2340
020	2·7	4	2·47	3·03	025	031	63·676	1·5728	1·9266	211	2522	3089
025	3·4	5	3·07	3·76	032	039	63·988	1·9644	2·4074	261	3150	3859
030	4·1	6	3·67	4·49	038	046	64·300	2·3598	2·8907	311	3784	4635
035	4·7	7	4·27	5·23	044	054	64·612	2·7589	3·3797	361	4424	5419
040	5·4	8	4·87	5·96	051	062	64·924	3·1618	3·8732	412	5071	6212
045	6·0	9	5·45	6·67	057	071	65·236	3·5554	4·2554	462	5702	6985
050	6·7	10	6·02	7·37	063	077	65·548	3·9460	4·8340	512	6328	7751
055	7·4	11	6·59	8·07	070	085	65·681	4·3284	5·3023	562	6960	8526
060	8·0	12	7·16	8·77	076	093	66·173	4·7380	5·8041	612	7598	9308
065	8·7	13	7·73	9·47	082	102	66·485	5·1383	6·2945	662	8242	1·0096
070	9·4	14	8·32	10·19	089	109	66·797	5·5585	6·8093	712	8912	0917
075	10·0	15	8·90	10·90	096	117	67·109	5·9727	7·3166	762	9578	1733
080	10·6	16	9·47	11·60	103	125	67·421	6·3848	7·8214	812	1·0239	2543
085	11·2	17	10·04	12·30	109	133	67·733	6·8004	8·3006	862	0905	3359
090	11·9	18	10·60	12·99	116	142	68·045	7·2128	8·8358	912	1567	4169
095	12·4	19	11·16	13·67	122	150	68·358	7·6287	9·3460	962	2234	4987
100	13·0	20	11·71	14·35	129	158	68·670	8·0412	9·8507	11·012	2895	5797
105	13·6	21	12·27	15·03	136	166	68·982	8·4641	10·3687	062	3573	6627
110	14·2	22	12·82	15·71	143	175	69·294	8·8835	10·8825	112	4246	7463
115	14·9	23	13·36	16·36	149	183	69·606	9·2993	11·3918	162	4912	8277
120	15·4	24	13·89	17·01	156	191	69·918	9·7116	11·8969	212	5573	9078
125	16·0	25	14·42	17·66	162	199	70·230	10·1272	12·4061	262	6240	9894
130	16·5	26	14·95	18·31	169	207	70·543	10·5462	12·9194	313	6913	2·0728

135	17·1	27	15·48	18·96	176	215	70·855	10·9683	13·4364	363	7590	1548
140	17·7	28	16·01	19·61	183	223	71·167	11·3938	13·9576	413	8272	2383
145	18·3	29	16·54	20·26	189	231	71·469	11·8210	14·4810	463	8960	3226
150	18·8	30	17·07	20·91	196	239	71·791	12·2547	15·0123	513	9653	4085
155	19·3	31	17·59	21·55	203	248	72·103	12·6829	15·5369	563	2·0339	4915
160	19·8	32	18·11	22·19	210	257	72·415	13·1144	16·0654	613	1031	5763
165	20·3	33	18·64	22·83	217	266	72·728	13·5565	16·6072	663	1743	6635
170	20·9	34	19·16	23·47	224	275	73·040	13·9945	17·1437	713	2442	7492
175	21·4	35	19·69	24·12	231	284	73·352	14·4430	17·6931	763	3161	8373
180	22·0	36	20·21	24·76	238	292	73·664	14·9875	18·3601	813	3874	9245
185	22·5	37	20·73	25·40	246	301	73·976	15·3352	18·7860	863	4592	3·0125
190	23·0	38	21·26	26·04	253	310	74·288	15·7936	19·3471	913	5327	1026
195	23·5	39	21·78	26·68	260	319	74·600	16·2479	19·9041	963	6055	1918
200	24·0	40	22·30	27·32	268	328	74·912	16·7054	20·4644	12·013	6789	2817
205	24·5	41	22·82	27·95	275	337	75·225	17·1663	21·0291	063	7528	3722
210	25·0	42	23·33	28·58	282	346	75·237	17·5538	21·5037	113	8247	4603
215	25·5	43	23·84	29·21	290	355	75·849	18·0824	22·0852	163	8997	5521
220	26·0	44	24·36	29·84	297	364	76·161	18·5528	22·7277	213	9751	6445
225	26·4	45	24·84	30·48	305	373	76·473	18 9959	23·2705	264	3·0464	7318
230	26·9	46	25·39	31·11	312	382	76·785	19·4967	23·8839	314	1265	8300
235	27·4	47	25·88	31·70	320	391	77·097	19·9527	24·4480	364	1998	9197
240	27·9	48	26·35	32·28	327	400	77·410	20·3975	24·9875	414	2711	4·0071
245	28·4	49	26·83	32·86	334	409	77·722	20·8528	25·5552	464	3441	0966
250	28·8	50	27·29	33·43	341	418	78·034	21·2955	26·0874	514	4152	1837
255	29·3	51	27·76	34·00	348	426	78·346	21·7488	26·6428	564	4898	2750
260	29·7	52	28·22	34·57	356	435	78·658	22·1963	27·1911	614	5597	3607
265	30·2	53	28·69	35·14	363	444	78·970	22·6565	27·7552	664	6333	4508
270	30·6	54	29·15	35·71	370	454	79·282	23·1107	28·3005	714	7061	5400
275	31·1	55	29·62	36·29	377	462	79·594	23·5756	28·8805	764	7811	6319
280	31·5	56	30·10	36·87	385	472	79·907	24·0520	29·4645	814	8570	7249
285	32·0	57	30·57	37·45	393	481	80·219	24·5229	30·0413	864	9325	8174
290	32·4	58	31·04	38·03	400	490	80·531	24·9968	30·6211	914	4·0085	9105
295	32·8	59	31·52	38·61	408	500	80·843	25·4817	31·2158	964	0862	5·0056
300	33·3	60	31·99	39·19	416	510	81·155	25·9615	31·8036	13·014	1632	0999
305	33·7	61	32·46	39·77	424	519	81·467	26·4442	32·3949	064	2406	1948
310	34·2	62	32·94	40·35	432	529	81·779	26·9380	32·9998	114	3198	2918
315	34·6	63	33·41	40·93	439	538	82·092	27·4269	33·5988	165	3984	3880
320	35·0	64	33·88	41·50	447	548	82·404	27·9185	34·2010	215	4772	4846

TABLE LXXIIc.—*continued.*

34—IV. Specific Gravity, etc., of Sulphuric Acid—*continued.*

Specific Gravity $\frac{15^\circ}{4^\circ}$ in vacuo.	Degrees Baumé.	Degrees Twaddell.	100 parts by weight contain		Kilogrammes per Litre.		Pounds per Foot Cube.			Pounds per Gallon.		
			SO_3.	H_2SO_4.	SO_3.	H_2SO_4.	Total.	SO_3.	H_2SO_4.	Total.	SO_3.	H_2SO.
1·325	35·4	65	34·35	42·08	0·455	0·557	82·712	28·4116	34·8051	13·265	4·5565	5·5818
330	35·8	66	34·80	42·66	462	567	83·028	28·8937	35·3956	315	6336	6752
335	36·2	67	35·27	43·20	471	577	83·340	29·3940	36·0035	365	7138	7745
340	36·6	68	35·71	43·74	479	586	83·652	29·8721	36·5942	415	7905	8684
345	37·0	69	36·14	44·28	486	596	83·964	30·3446	37·1730	465	8662	9612
350	37·4	70	36·58	44·82	494	605	84·277	30·8285	37·7658	515	9438	6·0562
355	37·8	71	37·02	45·37	502	614	84·589	31·3148	38·3615	565	5·0218	1518
360	38·2	72	37·45	45·88	509	624	84·901	31·7954	38·9504	615	0989	2463
365	38·6	73	37·89	46·41	517	633	85·213	32·2872	39·5428	665	1777	3428
370	39·0	74	38·32	46·94	525	643	85·525	32·7732	40·1236	715	2556	4383
375	39·4	75	38·75	47·47	533	653	85·837	33·2618	40·7456	765	3339	5342
380	39·8	76	39·18	48·00	541	662	86·149	33·7532	41·3486	815	4127	6307
385	40·1	77	39·62	48·53	549	672	86·461	34·2558	41·9643	865	4933	7294
390	40·5	78	40·05	49·06	557	682	86·774	34·7530	42·5735	915	5730	8271
395	40·8	79	40·48	49·59	564	692	87·086	35·2524	43 1852	965	6530	9251
400	41·2	80	40·91	50·11	573	702	87·398	35·7545	43·8003	14·015	7335	7·0237
405	41·6	81	41·33	50·63	581	711	87·710	36·2508	44·4083	066	8135	1217
410	42·0	82	41·76	51·15	589	721	88·022	36·7580	45·0296	116	8948	2212
415	42·3	83	42·17	51·66	597	730	88·334	37·2504	45·6328	166	9738	3180
420	42·7	84	42·57	52·15	604	740	88·646	37·7366	46·2285	216	6·0517	4135
425	43·1	85	42·96	52·63	612	750	88·959	38·2168	46·8167	266	1287	5078
430	43·4	86	43·36	53·11	620	759	89·271	38·7079	47·4184	316	2074	6041
435	43·8	87	43·75	53·59	628	769	89·583	39·1926	48·0121	366	2851	6994
440	44·1	88	44 14	54·07	636	779	89·895	39·6797	48·6088	416	3632	7951
445	44·4	89	44·53	54·55	643	789	90·207	40·1692	49·2085	466	4417	8912
450	44·8	90	44·92	55·03	651	798	90·519	40·6611	49·8111	516	5206	9879
455	45·1	91	45·31	55·50	659	808	90·831	41·1555	50·4167	566	5999	8·0851

460	45·4	92	45·69	55·97	667	818	91·143	41·6432	51·0142	616	6780	1807
465	45·8	93	46·07	56·43	675	827	91·456	42·1338	51·6142	666	7566	2771
470	46·1	94	46·45	56·90	683	837	91·768	42·6262	52·2184	716	8356	3738
475	46·4	95	46·83	57·37	691	846	92·080	43·1211	52·8246	766	9149	4709
480	46·8	96	47·21	57·83	699	856	92·392	43·6183	53·4337	816	9946	5686
485	47·1	97	47·57	58·28	707	866	92·704	44·0993	54·0229	866	7·0718	6631
490	47·4	98	47·95	58·74	715	876	93·016	44·6012	54·6388	916	1522	7616
495	47 8	99	48·34	59·22	723	885	93·328	45·1147	55·2668	967	2350	8631
500	48·1	100	48·73	59·70	731	896	93·641	45·6313	55·8997	15·017	3178	9645
505	48·4	101	49·12	60·18	739	906	93·953	46·1497	56·5347	067	4009	9·0663
510	48·7	102	49·51	60·65	748	916	94·265	46·6706	57·1729	117	4844	1686
515	49·0	103	49·89	61·12	756	926	94·577	47·1845	57·8028	167	5670	2698
520	49·4	104	50·28	61·59	764	936	94·889	47·7102	58·4464	217	6511	3728
525	49·7	105	50·66	62·06	773	946	95·200	48·2283	59 0811	267	7343	4747
530	50·0	106	51·04	62·53	781	957	95·512	48·7493	59·7193	317	8178	5770
535	50·3	107	51·43	63·00	789	967	95·825	49·2828	60·3729	367	9032	6816
540	50·6	108	51·78	63·43	797	977	96·137	49·7920	60·9967	417	9829	7793
545	50·9	109	52·12	63·85	805	987	96·449	50·2692	61·5813	467	8·0614	8754
550	51·2	110	52·46	64·26	813	996	96·761	50·7608	62·1835	517	1402	9720
555	51·5	111	52·79	64·67	821	1·006	97·073	51·2448	62·7764	567	2178	10·0670
560	51·8	112	53·12	65·08	829	015	97·385	51·7309	63·3720	617	2958	1626
565	52 1	113	53·46	65·49	837	025	97·697	52·2288	63·9818	668	3761	2610
570	52·4	114	53·80	65·90	845	034	98·009	52·7288	64·5943	718	4563	3592
575	52·7	115	54·13	66·30	853	044	98·322	53·2217	65·1982	768	5352	4559
580	53·0	116	54·46	66·71	861	054	98·634	53·7361	65·8309	818	6145	5531
585	53·3	117	54·80	67·13	869	064	98·946	54·2224	66·4240	868	6957	6525
590	53·6	118	55·18	67·59	877	075	99·258	54·7706	67·0957	918	7835	7601
595	53·9	119	55·55	68·05	886	085	99·570	55·3111	67·7578	968	8702	8662
600	54·1	120	55·93	68·51	895	096	99·882	55·8640	68·4351	16·018	9589	9749
605	54·4	121	56·30	68·97	904	107	100·194	56·4092	69·1030	068	9·0463	11·0829
610	54·7	122	56·68	69·43	913	118	100·507	56·9674	69·7868	118	1357	1915
615	55·0	123	57·05	69·89	921	128	100·819	57·5172	70·4593	168	2248	3006
620	55·2	124	57·40	70·32	930	139	101·131	58 0492	71·1120	218	3091	4039
625	55·5	125	57·75	70·74	938	150	101·443	58·5833	71·7663	268	3948	5089
630	55·8	126	58·09	71·16	947	160	101·755	59·1095	72·4109	318	4791	6122
635	56·0	127	58·43	71·57	955	170	102·067	59·6377	73·0580	368	5638	7159
640	56·3	128	58·77	71·99	964	181	102·379	60·1681	73·7078	418	6489	8202
645	56·6	129	59·10	72·40	972	192	102·691	60·6904	74·3475	468	7326	9227

TABLE LXXIIc.—*continued.*

34—IV. Specific Gravity, etc., of Sulphuric Acid—*continued.*

Specific Gravity $\frac{15°}{4°}$ in vacuo.	Degrees Baumé.	Degrees Twaddell.	100 parts by weight contain		Kilogrammes per Litre.		Pounds per Foot Cube.			Pounds per Gallon.		
			SO_3.	H_2SO_4.	SO_3.	H_2SO_4.	Total.	SO_3.	H_2SO_4.	Total.	SO_3.	H_2SO_4.
1·650	56·9	130	59·45	72·82	0·981	1·202	103·004	61·2359	75·0159	16·518	9·8200	12·0298
655	57·1	131	59·78	73·23	989	212	103·316	61·7623	75·6607	569	9049	1341
660	57·4	132	60·11	73·64	998	222	103·628	62·2908	76·3081	619	9897	2376
665	57·6	133	60·46	74·07	1·007	233	103·940	62·8421	76·9836	669	10·0781	3460
670	57·9	134	60·82	74·51	016	244	104·252	63·4061	77·6744	719	1685	4567
675	58·2	135	61·20	74·97	025	256	104·564	63·9932	78·3936	769	2626	5720
680	58·4	136	61·57	75·42	034	267	104·876	64·5722	79·1039	819	3550	6852
685	58·7	137	61·93	75·86	043	278	105·188	65·1429	79·8021	869	4470	7979
690	58·9	138	62·29	76·30	053	289	105·501	65·7166	80·5049	919	5388	9103
695	59·2	139	62·64	76·73	062	301	105·813	66·2813	81·1976	969	6294	13·0213
700	59·5	140	63·00	77·17	071	312	106·125	66·8588	81·9041	17·019	7220	1357
705	59·7	141	63·35	77·60	080	323	106·437	67·4277	82·6010	069	8132	2464
710	60·0	142	63·70	78·04	089	334	106·749	67·9991	83·3009	119	9048	3584
715	60·2	143	64·07	78·48	099	346	107·061	68·5940	84·0298	169	11·0002	4755
720	60·4	144	64·43	78·92	108	357	107·373	69·1804	84·7481	219	0942	5907
725	60·6	145	64·78	79·36	118	369	107·686	69·7590	85·4570	269	1869	7043
730	60·9	146	65·14	79·80	127	381	107·998	70·3499	86·1808	319	2816	8203
735	61·1	147	65·50	80·24	136	392	108·310	70·9431	86·9075	369	3767	9368
740	61·4	148	65·86	80·68	146	404	108·622	71·5384	87·6367	420	4728	14·0545
745	61·6	149	66·22	81·12	156	416	108·934	72·1361	88·3690	470	5686	1719
750	61·8	150	66·58	81·56	165	427	109·246	72·7360	89·1039	520	6648	2897
755	62·1	151	66·94	82·00	175	439	109·558	73·3381	89·8415	570	7614	4080
760	62·3	152	67·30	82·44	185	451	109·870	73·9425	90·5819	620	8583	5267
765	62·5	153	67·65	82·88	194	463	110·183	74·5388	91·3123	670	9538	6437
770	62·8	154	68·02	83·32	204	475	110·495	75·1587	92·0717	720	12·0531	7654
775	63·0	155	68·49	83·90	216	489	110·807	75·8917	92·9697	770	1707	9094
780	63·2	156	68·93	84·50	228	504	111·119	76·6499	93·8984	820	2922	15·0583

785	63·5	157	69·47	85·10	240	519	111·431	77·4111	94·8310	870	4143	2078
790	63·7	158	69·96	85·70	252	534	111·743	78·1754	95·7672	920	5388	3603
795	64·0	159	70·45	86·30	265	549	112·055	78·9427	96·7072	970	6599	5088
800	64·2	160	70·94	86·90	277	564	112·368	79·7139	97·6520	18·020	7834	6500
805	64·4	161	71·50	87·60	291	581	112·680	80·5662	98·6961	070	9201	8274
810	64·6	162	72·08	88·30	305	598	112·992	81·4446	99·7721	120	13·0609	16·0000
815	64·8	163	72·69	89·05	319	621	113·304	82·3605	100·8942	170	2078	1799
820	65·0	164	73·51	90·05	338	639	113·616	83·5191	102·3135	221	3943	4084
821			73·63	90·20	341	643	113·678	83·7011	102·5364	231	4235	4442
822	65·1		73·80	90·40	345	647	113·741	83·9409	102·7302	241	4619	4913
823			73·98	90·60	348	651	113·803	84·1915	103·1372	251	5021	5405
824	65·2		74·12	90·80	352	656	113·866	84·3975	103·3895	261	5351	5809
825		165	74·29	91·00	356	661	113·928	84·6371	103·6830	271	5735	6280
826	65·3		74·49	91·25	360	666	113·991	84·9119	104·0198	281	6175	6818
827			74·69	91·50	364	671	114·053	85·1862	104·3558	291	6615	7357
828	65·4		74·86	91·70	368	676	114·115	85·4265	104·6502	301	7001	7830
829			75·03	91·90	372	681	114·178	85·6673	104·9451	311	7387	8303
830		166	75·19	92·10	376	685	114·240	85·8971	105·2266	321	7756	8755
831	65·5		75·35	92·30	380	690	114·303	86·1273	105·5086	331	8124	9206
832			75·53	92·52	384	695	114·365	86·3799	105·8190	341	8530	9704
833	65·6		75·72	92·75	388	700	114·428	86·6449	106·1427	351	8972	17·0245
834			75·96	93·05	393	706	114·490	86·9666	106·5368	361	9470	0855
835	65·7	167	76·27	93·43	400	713	114·552	87·3688	107·0294	371	14·0116	1646
836			76·57	93·80	406	722	114·615	87·7607	107·5195	381	0743	2414
837			76·90	94·20	412	730	114·677	88·1866	108·0313	391	1427	3252
838	65·8		77·23	94·60	419	739	114·740	88·6137	108·5545	401	2111	4090
839			77·55	95·00	426	748	114·802	88·6990	108·6590	411	2777	4906
8400	65·9	168	78·04	95·60	436	759	114·865	89·6406	109·8125	421	3757	6106
8405			78·33	95·95	441	765	114·896	89·9980	110·2530	426	4331	6810
8410			79·19	97·00	458	786	114·927	91·0107	111·4934	431	5955	8800
8415			79·76	97·70	469	799	114·958	91·6905	112·3237	436	7046	18·0136
8415			80·16	98·20	476	808	114·958	92·1483	112·8845	436	7783	1040
8400			80·57	98·70	483	816	114·865	92·5467	113·3725	421	8418	1816
8400			80·98	99·20	490	825	114·865	93·0177	113·9496	421	9173	2741
8395			81·18	99·45	494	830	114·834	93·2222	114·2000	416	9498	3139
8390			81·39	99·70	497	834	114·802	93·4373	114·4635	411	9847	3567
8385			81·59	99·95	500	838	114·771	93·6417	114·7139	406	15·0175	3969

TABLE LXXIIc.—*continued.*

34—v. Specific Gravity, etc., of Concentrated Sulphuric Acid at 15° C. (Richmond, calculated from Pickering's results.)

Specific Gravity.	Percentage of H_2SO_4.	Specific Gravity.	Percentage of H_2SO_4.	Specific Gravity.	Percentage of H_2SO_4.	Specific Gravity.	Percentage of H_2SO_4.	Specific Gravity.	Percentage of H_2SO_4.	Specific Gravity.	Percentage of H_2SO_4.	Specific Gravity.	Percentage of H_2SO_4.
1·8200	89·97	1·8240	90·70	1·8280	91·52	1·8320	92·46	1·8361	93·59	1·8401	95·00	1·8423	98·71
8201	99	8241	72	8281	54	8321	49	8362	62	8402	04	8422	78
8202	90·01	8242	74	8282	56	8322	52	8363	65	8403	08	8421	84
8203	02	8243	76	8283	59	8323	54	8364	68	8404	12	8420	84
8204	04	8244	78	8284	61	8324	56	8365	71	8405	16	8419	94
8205	06	8245	80	8285	63	8325	59	8366	74	8406	21	8418	98
8206	08	8246	82	8286	65	8326	61	8367	77	8407	25	8417	99·02
8207	10	8247	84	8287	68	8327	63	8368	80	8408	30	8416	06
8208	11	8248	86	8288	70	8328	66	8369	83	8409	35	8415	11
8209	13	8249	88	8289	72	8329	69	8370	87	8410	40	8414	16
8210	15	8250	90	8290	74	8330	71	8371	90	8411	45	8413	19
8211	17	8251	92	8291	76	8331	73	8372	93	8412	50	8412	22
8212	18	8252	94	8292	78	8332	77	8373	97	8413	55	8411	25
8213	20	8253	96	8293	81	8333	79	8374	94·00	8414	61	8410	29
8214	23	8254	98	8294	84	8334	82	8375	03	8415	67	8409	33
8215	24	8255	91·00	8295	86	8335	84	8376	07	8416	74	8408	37
8216	26	8256	02	8296	88	8336	87	8377	10	8417	81	8407	40
8217	28	8257	04	8297	91	8337	90	8378	13	8418	88	8406	43
8218	29	8258	06	8298	93	8338	93	8379	17	8419	95	8405	46
8219	31	8259	08	9299	95	8339	95	8380	20	8420	96·02	8404	49

8220	33	8260	10	8300	98	8341	98	8381	24	8421	09	8403	52
8221	35	8261	12	8301	92·00	8342	93·00	8382	27	8422	16	8402	55
8222	37	8262	14	8302	02	8343	06	8383	31	8423	24	8401	58
8223	38	8263	16	8303	05	8344	09	8384	34	8424	31	8400	61
8224	40	8264	18	8304	07	8345	12	8385	38	8425	39	8399	64
8225	42	8265	20	8305	10	8346	14	8386	42	8426	46	8398	67
8226	44	8266	22	8306	12	8347	17	8387	46	8427	55	8397	70
8227	46	8267	24	8307	15	8348	20	8388	49	8428	65	8396	73
8228	47	8268	26	8308	17	8349	23	8389	53	8429	76	8395	76
8229	49	8269	28	8309	19	8350	26	8390	57	8430	93	8394	78
8230	51	8270	30	8310	22	8351	29	8391	61	8431	97·10	8393	81
8231	53	8271	32	8311	24	8352	32	8392	65	8432	50	8392	84
8232	55	8272	35	8312	27	8353	35	8393	69	8431	85	8391	86
8233	57	8273	37	8313	29	8354	38	8394	73	8430	98·08	8390	88
8234	59	8274	39	8314	32	8355	41	8395	77	8429	22	8389	90
8235	60	8275	41	8315	34	8356	44	8396	81	8428	32	8388	92
8236	62	8276	43	8316	37	8357	47	8397	84	8427	40	8387	94
8237	64	8277	45	8317	39	8358	50	8398	88	8426	48	8386	96
8238	66	8278	47	8318	41	8359	53	8399	92	8425	56	8385	98
8239	68	8279	50	8319	44	8360	56	8400	96	8424	63	8384	100·00

TABLE LXXIIc.—*continued.*

35. Table for reducing the Specific Gravities of Sulphuric Acid of various Strengths to any other Temperature (Degrees C.).

0°	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°	75°	80°	85°	90°	95°	100°
1·857	1·852	1·846	1·840	1·835	1·830	1·825	1·821	1·816	1·811	1·806	1·800	1·796	1·792	1·787	1·782	1·778	1·774	1·770	1·766	1·762
847	841	836	830	825	820	815	810	805	800	795	790	787	781	776	770	766	762	757	752	748
837	831	825	820	815	809	804	799	794	789	784	779	774	769	764	759	754	749	744	739	734
827	821	815	810	805	799	793	788	783	778	773	767	762	757	752	747	741	736	731	726	721
817	811	805	800	794	788	783	777	772	766	761	755	750	744	739	734	729	724	719	714	708
807	801	796	790	784	778	773	767	762	756	751	746	741	735	730	725	720	715	710	705	700
797	791	786	780	774	768	763	757	752	746	741	736	731	726	721	716	712	707	702	697	692
786	781	776	770	765	759	754	748	743	737	732	727	722	717	712	707	702	697	693	688	683
776	770	765	760	755	749	744	738	733	728	723	718	713	708	703	698	693	688	684	679	674
765	760	755	750	745	740	735	730	725	720	715	710	705	700	695	690	685	681	676	671	667
754	750	745	740	735	730	726	721	716	711	706	702	697	692	688	683	678	674	669	664	660
744	740	735	730	725	720	716	711	706	701	696	692	687	683	678	673	668	664	659	654	650
734	730	725	720	715	710	706	701	696	691	686	682	677	673	668	663	659	654	649	644	640
724	720	715	710	705	700	696	691	686	681	676	672	667	663	658	653	649	644	639	635	630
714	710	705	700	695	690	686	681	676	671	667	662	657	653	648	644	639	634	630	625	620
704	700	695	690	685	680	676	671	666	661	656	652	647	642	638	634	630	625	620	615	610
694	690	685	680	675	670	666	661	656	651	646	642	637	632	628	624	620	615	611	606	602
684	680	675	670	665	660	656	651	646	641	637	633	628	623	619	615	611	606	602	597	593
674	670	665	660	655	650	646	641	636	632	628	623	619	614	610	606	602	597	593	588	584
664	660	655	650	645	640	636	632	627	622	618	614	610	605	600	596	592	588	583	579	575
654	650	645	640	635	631	626	622	617	612	608	604	600	595	591	586	582	578	574	570	565
644	640	635	630	625	621	616	612	607	602	598	594	590	585	581	577	573	569	565	561	556
634	630	625	620	615	611	606	602	597	592	588	584	580	576	572	568	564	560	556	552	547
624	620	615	610	605	601	596	592	587	582	578	574	570	566	562	558	554	550	546	542	537
614	610	605	600	595	591	586	582	577	572	568	564	560	556	552	548	544	540	536	531	527
604	600	595	590	585	581	576	572	567	562	558	554	550	545	541	537	533	529	525	521	516
594	589	584	580	575	570	566	562	558	553	548	544	539	535	531	527	523	519	515	510	503
584	579	574	570	566	561	556	552	548	543	539	535	531	526	522	518	513	509	505	501	496
574	569	564	560	556	552	547	543	539	534	530	526	522	517	513	509	504	500	496	492	487
563	558	554	550	546	542	538	534	530	525	521	517	513	509	504	500	495	491	487	483	478

552	548	544	540	536	532	528	524	520	516	512	508	504	500	495	491	486	482	478	473	469
542	538	534	530	526	522	518	514	510	506	502	498	494	490	485	481	476	472	468	463	459
532	528	524	520	516	512	508	504	500	497	492	488	484	480	476	472	467	462	458	453	449
522	518	514	510	506	502	498	494	490	486	482	478	474	470	466	462	457	452	448	443	438
512	508	504	500	496	492	488	484	480	476	472	468	464	460	455	451	446	442	438	433	428
502	498	494	490	486	482	478	474	470	466	462	458	454	450	442	441	437	433	429	424	419
492	488	484	480	476	472	468	465	461	457	453	449	445	441	436	432	428	424	419	414	410
482	478	474	470	466	462	458	455	451	447	443	439	435	431	427	423	418	414	409	405	401
472	468	464	460	456	452	448	445	442	438	434	430	426	422	418	413	409	405	400	396	392
462	458	454	450	446	442	438	435	432	429	425	421	417	413	409	404	400	396	391	387	383
452	448	444	440	436	432	429	426	423	420	416	412	407	403	399	395	391	386	382	378	374
442	438	434	430	426	422	419	416	413	409	405	401	397	393	389	385	380	376	372	368	364
432	428	424	420	416	413	410	406	402	398	394	390	386	382	378	374	370	366	362	358	353
422	418	414	410	406	403	399	396	392	388	384	380	376	372	368	364	360	356	352	348	343
412	408	404	400	396	393	389	386	382	378	374	370	366	362	358	354	350	346	342	338	333
402	398	394	390	386	383	379	376	372	368	364	360	356	352	348						
392	388	384	380	376	373	370	367	362	359	355	351	346	342	338						
382	378	374	370	366	363	360	357	352	349	346	342	337	334	329						
372	368	364	360	356	353	350	347	344	340	336	332	327	323	319						
362	358	354	350	346	343	340	337	334	330	326	322	317	314	310						
352	348	344	340	336	333	330	327	324	320	316	312	308	304	300						
341	337	333	330	327	324	321	318	314	310	306	302	298	294	290						
330	326	323	320	317	314	311	308	304	301	297	293	289	284	280						
320	316	313	310	307	304	301	298	294	291	287	283	278	274	270						
310	306	303	300	297	294	291	288	284	281	277	273	269	265	260						
300	296	293	290	287	284	280	277	274	270	267	263	259	255	250						
290	286	283	280	277	274	270	267	264	260	256	252	248	244	240						
280	276	273	270	267	264	260	257	254	250	246	242	238	234	230						
270	266	263	260	257	254	251	248	245	241	237	233	228	224	220						
260	256	253	250	247	244	241	238	235	231	227	223	218	214	210						
250	246	243	240	237	234	230	227	224	220	217	214	209	204	200						
240	236	233	230	227	224	220	217	214	210	207	204	200	195	190						
230	226	223	220	217	214	210	207	204	200	197	194	190	185	180						
220	216	213	210	206	204	200	197	194	190	187	183	179	175	170						
210	206	203	200	196	193	190	186	183	180	176	172	168	164	160						
200	196	193	190	186	183	180	176	173	169	165	162	158	154	150						
190	186	183	180	176	173	170	166	163	159	155	152	148	144	140						
180	176	173	170	166	163	160	156	153	149	146	143	139	135	131						

TABLE LXXIIc.—*continued.*

35. Table for reducing the Specific Gravities of Sulphuric Acid, etc.—*continued.*

0°	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°
1·169	1·166	1·163	1·160	1·157	1·153	1·150	1·147	1·144	1·141	1·138	1·135	1·131	1·127	1·123
159	156	153	150	147	143	140	137	134	131	128	125	122	118	114
149	146	143	140	137	134	131	128	125	122	119	116	113	109	106
138	135	133	130	127	125	122	119	116	113	110	107	104	100	097
128	125	123	120	118	115	112	110	107	104	102	099	096	092	088
118	115	113	110	108	105	102	100	097	094	092	089	086	082	078
108	105	103	100	097	094	092	090	087	084	082	079	075	072	068
098	095	093	090	087	084	082	080	077	074	072	069	065	062	058
088	085	083	080	077	074	072	070	067	064	062	059	055	052	048
078	075	073	070	067	064	062	060	057	054	052	049	045	042	038
068	065	063	060	057	054	052	050	048	044	042	039	035	032	028
058	055	053	050	047	044	042	040	038	034	032	029	025	022	018
048	045	043	040	037	034	032	030	028	024	022	019	015	012	008
038	035	033	030	027	024	022	020	018	014	012	009	005	002	0·998
028	025	023	020	017	014	012	010	008	004	002	0·999	0·995	0·992	988
018	015	013	010	007	004	002	000	0·998	0·994	0·992	989	985	982	978

TABLE LXXIIc.—*continued.*

36. Freezing and Melting Points of Sulphuric Acid. (Lunge.)

Specific Gravity at 15° C.	Freezing Point.	Melting Point.
1·671	Liquid at −20°	
691	Liquid at −20	
712	Liquid at −20	
727	−7·5°	−7·5°
732	−8·5	−8·5
749	−0·2	+4·5
767	+1·6	+6·5
778	+8·5	+8·5
790	+4·5	+8·0
807	−9·0	−6·0
822	Liquid at −20°	
840	Liquid at −20	

37. Boiling Points of Sulphuric Acid. (Lunge.)

Per cent. H_2SO_4.	Specific Gravity.	Boiling Point.	Per cent. H_2SO_4.	Specific Gravity.	Boiling Point.	Per cent. H_2SO_4.	Specific Gravity.	Boiling Point.
5	1·031	101° C.	56	1·459	133° C.	82	1·758	218°·5 C.
10	069	102	60	503	141 ·5	84	773	227
15	107	103 ·5	62 ·5	530	147	86	791	238 ·5
20	147	105	65	557	153 ·5	88	807	251 ·5
25	184	106 ·5	67 ·5	585	161	90	818	262 ·5
30	224	108	70	615	170	91	824	268
35	265	110	72	639	174 ·5	92	830	274 ·5
40	307	114	74	661	180 ·5	93	834	281 ·5
45	352	118 ·5	76	688	189	94	837	288 ·5
50	399	124	78	710	199	95	840	295
53	428	128 ·5	80	733	207			

TABLE LXXIIc.—*continued.*

38. Percentage of SO_3 in Nordhausen Oil of Vitriol.

Percentage of free SO_3 = (Percentage found by Titrating − 81·6326) × 5·4444 ; or, more accurately (Percentage found by Titrating − 81·6306) × 5·4438.

Found by Titrating	Contains per cent.		Found by Titrating	Contains per cent.		Found by Titrating	Contains per cent.	
SO_3.	H_2SO_4.	Free SO_3.	SO_3.	H_2SO_4.	Free SO_3.	SO_3.	H_2SO_4.	Free SO_3.
81·6326	100	0	87·8775	66	34	94·1224	32	68
81·8163	99	1	88·0612	65	35	94·3061	31	69
82·0000	98	2	88·2448	64	36	94·4897	30	70
82·1836	97	3	88·4285	63	37	94·6734	29	71
82·3674	96	4	88·6122	62	38	94·8571	28	72
82·5510	95	5	88·7959	61	39	95·0408	27	73
82·7346	94	6	88·9795	60	40	95·2244	26	74
82·9183	93	7	89·1632	59	41	95·4081	25	75
83·1020	92	8	89·3469	58	42	95·5918	24	76
83·2857	91	9	89·5306	57	43	95·7755	23	77
83·4693	90	10	89·7142	56	44	95·9591	22	78
83·6530	89	11	89·8979	55	45	96·1428	21	79
83·8367	88	12	90·0816	54	46	96·3265	20	80
84·0204	87	13	90·2653	53	47	96·5102	19	81
84·2040	86	14	90·4489	52	48	96·6938	18	82
84·3877	85	15	90·6326	51	49	96·8775	17	83
84·5714	84	16	90·8163	50	50	97·0612	16	84
84·7551	83	17	91·0000	49	51	97·2448	15	85
84·9387	82	18	91·1836	48	52	97·4285	14	86
85·1224	81	19	91·3673	47	53	97·6122	13	87
85·3061	80	20	91·5510	46	54	97·7959	12	88
85·4897	79	21	91·7346	45	55	97·9795	11	89
85·6734	78	22	91·9183	44	56	98·1632	10	90
85·8571	77	23	92·1020	43	57	98·3469	9	91
86·0408	76	24	92·2857	42	58	98·5306	8	92
86·2244	75	25	92·4093	41	59	98·7142	7	93
86·4081	74	26	92·6530	40	60	98·8979	6	94
86·5918	73	27	92·8367	39	61	99·0816	5	95
86·7755	72	28	93·0204	38	62	99·2653	4	96
86·9591	71	29	93·2040	37	63	99·4489	3	97
87·1428	70	30	93·3877	36	64	99·6326	2	98
87·3265	69	31	93·5714	35	65	99·8163	1	99
87·5102	68	32	93·7551	34	66			
87·6938	67	33	93·9387	33	67			

TABLE LXXIIc.—*continued.*

39. Table for the Preparation of Solutions of Sulphuric Acid of given strength by mixing Acid of Specific Gravity 1·85 with Water. (Author.)

100 parts Water at 15°-20° C., mixed with n parts of Acid of Specific Gravity of 1·85.	Give Acid possessing a Specific Gravity of	100 parts Water at 15°-20° C., mixed with n parts of Acid of Specific Gravity of 1·85.	Give Acid possessing a Specific Gravity of	100 parts Water at 15°-20° C., mixed with n parts of Acid of Specific Gravity of 1·85.	Give Acid possessing a Specific Gravity of
$n=$ 1	1·009	$n=$130	1·456	$n=$370	1·723
2	015	140	473	380	727
5	035	150	490	390	730
10	060	160	510	400	733
15	090	170	530	410	737
20	113	180	543	420	740
25	140	190	556	430	743
30	165	200	568	440	746
35	187	210	580	450	750
40	210	220	593	460	754
45	229	230	606	470	757
50	248	240	620	480	760
55	265	250	630	490	763
60	280	260	640	500	766
65	297	270	648	510	768
70	312	280	654	520	770
75	326	290	667	530	772
80	340	300	678	540	774
85	357	310	689	550	776
90	372	320	700	560	777
95	386	330	705	570	778
100	398	340	710	580	779
110	420	350	714	590	780
120	438	360	719	600	782

TABLE LXXIIc.—*continued.*

40 Specific Gravity, etc., of Concentrated Solutions of Sulphuric Acid at 15° C.

(Lunge and Naef.)

Percentage of H_2SO_4.	Specific Gravity.	Degrees Baumé.	Percentage of H_2SO_4.	Specific Gravity.	Degrees Baumé.	Percentage of H_2SO_4.	Specific Gravity.	Degrees Baumé.
90	1·8185	65·1	94	1·8372	65·9	98	1·8412	
90·20	8195		94·84	8387		98·39	8406	
91	8241	65·4	95	8390	66·0	98·66	8409	
91·48	8271		95·97	8406		99	8403	
92	8294	65·6	96	8406	66·0	99·47	8395	
92·83	8334		97	8410		100·00	8384	
93	8339	65·8	97·70	8413				

41. Specific Gravity, etc., of Sulphurous Acid Solutions at 15° C. (Scott.)

Specific Gravity.	Percentage of SO_2.	Specific Gravity.	Percentage of SO_2.	Specific Gravity.	Percentage of SO_2.	Specific Gravity	Percentag of SO_2.
1·0028	0·5	1·0168	3·0	1·0302	5·5	1·0426	8·0
0056	1·0	0194	3·5	0328	6·0	0450	8·5
0085	1·5	0221	4·0	0353	6·5	0474	9·0
0113	2·0	0248	4·5	0377	7·0	0497	9·5
0141	2·5	0275	5·0	0401	7·5	0520	10·0

TABLE LXXIIc.—*continued.*

42. Specific Gravity, etc., of Sulphurous Acid Solutions at 15°·5 C. (Gerlach, from Giles and Schearer.)

Specific Gravity.	Percentage of SO_2.	Specific Gravity.	Percentage of SO_2.	Specific Gravity.	Percentage of SO_2.	Specific Gravity.	Percentage of SO_2.
1·0051	1	1·0252	5	1·0453	9	1·0656	13
0102	2	0302	6	0504	10		
0152	3	0352	7	0554	11		
0202	4	0402	8	0605	12		

42a. Specific Gravity, etc., of Selenic Acid Solutions. (Cameron and Macallan.)

Specific Gravity.	Percentage H_2SeO .	Specific Gravity.	Percentage H_2SeO_4.
1·9675	73·50	2·4081	91
2·0922	79	4322	92
1216	80	4596	93
1479	81	4925	94
1757	82	5163	95
1946	83	5388	96
2258	84	5601	97
2558	85	5695	97·5
2795	86	5767	98
3061	87	5863	98·5
3291	88	5975	99
3568	89	6051	99·5
3848	90	6083	99·73

TABLE LXXIIc.—*continued.*

43. Specific Gravity, etc., of Phosphoric Acid Solutions at 15° C. (Gerlach and Schiff.)

Specific Gravity.	Percentage of H_3PO_4.	Percentage of P_2O_5.	Specific Gravity.	Percentage of H_3PO_4.	Percentage of P_2O_5.
1·0054	1	0·726	1·1962	31	22·506
0109	2	1·452	2036	32	23·232
0164	3	2·178	2111	33	23·958
0220	4	2·904	2186	34	24·664
0276	5	3·630	2262	35	25·410
0333	6	4·356	2338	36	26·136
0390	7	5·082	2415	37	26·862
0449	8	5·808	2493	38	27·588
0508	9	6·534	2572	39	28·314
0567	10	7·260	2651	40	29·040
0627	11	7·986	2731	41	29·766
0688	12	8·712	2812	42	30·492
0749	13	9·438	2894	43	31·218
0811	14	10·164	2976	44	31·944
0874	15	10·890	3059	45	32·670
0937	16	11·616	3143	46	33·496
1001	17	12·342	3227	47	34·222
1065	18	13·068	3313	48	34·948
1130	19	13·794	3399	49	35·674
1196	20	14·520	3486	50	36·400
1262	21	15·246	3573	51	37·126
1329	22	15·972	3661	52	37·852
1397	23	16·698	3750	53	38·578
1465	24	17·424	3840	54	39·304
1534	25	18·150	3931	55	40·030
1604	26	18·876	4022	56	40·756
1674	27	19·602	4114	57	41·482
1745	28	20·328	4207	58	42·208
1817	29	21·054	4301	59	42·934
1889	30	21·780	4395	60	43·660

TABLE LXXIIc.—*continued.*

44. Specific Gravity, etc., of Phosphoric Acid Solutions at 15°·5 C. (J. Watts.)

Specific Gravity.	Percentage of H_3PO_4.	Percentage of P_2O_5.	Specific Gravity.	Percentage of H_3PO_4.	Percentage of P_2O_5.	Specific Gravity.	Percentage of H_3PO_4.	Percentage of P_2O_5.
1·508	68·47	49·60	1·328	49·90	36·15	1·153	25·97	18·81
492	66·83	48·41	315	48·07	34·82	144	24·70	17·89
476	65·02	47·10	302	46·23	33·49	136	23·50	16·95
464	62·99	45·63	293	45·16	32·71	124	21·59	15·64
453	62·64	45·38	285	44·09	31·94	113	19·78	14·33
442	60·92	44·13	276	42·84	31·03	109	18·29	13·25
434	60·67	43·95	268	41·59	30·13	095	16·81	12·18
426	59·75	43·28	257	40·25	29·16	081	14·41	10·44
418	58·82	42·61	247	38·98	28·24	073	13·15	9·53
401	57·43	41·60	236	37·69	27·30	066	11·90	8 62
392	56·40	40·86	226	36·31	26·30	056	10·20	7·39
384	55·39	40·12	211	34·22	24·79	047	8·51	6 17
376	55·09	39·66	197	32·07	23·23	031	5·73	4·15
369	54·13	39·21	185	30·47	22·07	022	4·18	3·03
356	52·46	38·00	173	28·87	20·91	014	2·64	1 91
349	51·59	37·37	162	27·23	19·73	006	1·09	0·79
339	50·72	36·74						

45. (*a*) Specific Gravity, etc., of Solutions of H_2F_2 at 15° C. (Hart.)

Specific Gravity.	Percent. of H_2F_2.	Specific Gravity.	Percent. of H_2F_2.	Specific Gravity.	Percent. of H_2F_2.	Specific Gravity.	Percent. of H_2F_2.	Specific Gravity.	Percent. of H_2F_2.
1·01	2·9	1·06	17·4	1·11	31·9	1·16	46·4	1·21	60·9
02	5·8	07	20·3	12	34·8	17	49·3	22	63·8
03	8·7	08	23·2	13	37·7	18	52·2	23	66·7
04	11·6	09	26·1	14	40·6	19	55·1	24	69·6
05	14·5	10	29·0	15	43·5	20	58·0	25	72·5

(*b*) Specific Gravity, etc., of Sodium Fluoride Solutions at 15° C. (Gerlach.)

Specific Gravity.	Percentage NaF.
1·0110	1·108
0221	2·216
0333	3·324

(*c*) Specific Gravity, etc., of Potassium Fluoride Solutions at 18° C. (Kohlrausch.)

Specific Gravity.	Percentage KF.
1·041	5
084	10
176	20
272	30
378	40

TABLE LXXIIc.—*continued.*

46. Specific Gravity, etc., of Bromine Water. (Slessor.)

Specific Gravity.	Percentage of Br.	Specific Gravity.	Percentage of Br.	Specific Gravity.	Percentage of Br.
1·00901	1·022	1·01491	1·874 to 1·906	1·01807	2·089 to 2·155
00931	067				
00995	205	01585	1·952 to 2·009	02367	Saturated 3·102 to 3·169
01223	231				

47. Specific Gravity, etc., of Boracic Acid Solutions at 15° C. (Gerlach.)

Specific Gravity.	Percentage of H_3BO_3.
1·0034	1
0069	2
0106	3
0147	4

48. Specific Gravity, etc., of Chloric Acid Solutions at 14° C. (Kämmerer.)

Specific Gravity.	Percentage of	
	$HClO_3$.	Cl_2O_5.
1·128	19·000	16·98
161	23·823	21·29
262	39·982	35·73

49. Specific Gravity, etc., of Iodic Acid Solutions at 14° C.

Specific Gravity.	Percentage of		Specific Gravity.	Percentage of	
	HIO_3.	I_2O_5.		HIO_3.	I_2O.
1·0053	1·054	1	1·4428	36·890	35
0203	5·270	5	5371	42·160	40
0525	10·540	10	6315	47·430	45
1223	15·810	15	7256	52·700	50
2093	21·080	20	8689	57·970	55
2773	26·350	25	9954	63·240	60
3484	31·620	30	2·1209	68·510	65

TABLE LXXIIc.—*continued.*

50. Specific Gravity, etc., of Iodic Acid at 17° C.

Specific Gravity.	HIO_3+n Aq.	Specific Gravity.	HIO_3+n Aq.
1·6609	HIO_3 + 10 aq.	1·1004	HIO_3 + 80 aq.
3660	+ 20 „	0512	+ 160 „
1945	+ 40 „	0258	+ 320 „

51. Specific Gravity, etc., of Chromic Acid Solutions. (Zetnow, Gerlach, and Mendelejeff.)

Density at 15° C.	Specific Gravity at 17°·5 C.	Percentage of CrO_3.	Density at 15° C.	Specific Gravity at 17°·5 C.	Percentage of CrO_3.
0·9992	1·000	0	1·324	1·312	35
1·036	037	5	383	373	40
076	076	10	445	440	45
119	118	15	510	512	50
166	162	20	579	587	55
215	208	25		665	60
268	258	30			

52. Specific Gravity, etc., of Tungstic Acid Solutions. (Scheibler, Gerlach, and Mendelejeff.)

Density at 15° C.	Specific Gravity at 17°·5 C.	Percentage of WO_3.	Density at 15° C.	Specific Gravity at 17°·5 C.	Percentage of WO_3.
0·9992	1·0000	0	1·285	1·2873	25
1·047	0469	5	366	3660	30
098	0980	10	458	4540	35
153	1544	15	555	5527	40
214	2172	20	581	6630	45
				7860	50

52A. Specific Gravity, etc., of Metatungstic Acid, $H_2W_4O_{13}+7H_2O$, at 17°·5. (Scheibler.)

Specific Gravity, ...	1·0257	1·1275	1·3274	1·6343
Percentage WO_3, ...	2·79	12·68	27·61	43·75

TABLE LXXIIc.—*continued.*

52B. Specific Gravity, etc., of Colloidal Tungstic Acid. (Graham.)

Specific Gravity, . .	1·0475	1·2168	1·8001	2·596	3·234
Percentage WO_3, . .	5·	20·	50·	66·5	79·8

53. Specific Gravity, etc., of Per-iodic Acid Solutions at 17°.

Specific Gravity.	H_5IO_6+n Aq.	Specific Gravity.	H_5IO_6+n Aq.
1·4008	H_5IO_6 + 20 aq.	1·0570	H_5IO_6 + 160 aq.
2165	+ 40 ,,	0288	+ 320 ,,
1121	+ 80 ,,		

54. Specific Gravity, etc., of Hydrofluosilicic Acid at 17°·5 C. (Stolba.)

Specific Gravity.	Percentage of H_2SiF_6.	Specific Gravity.	Percentage of H_2SiF_6.	Specific Gravity.	Percentage of H_2SiF_6.	Specific Gravity.	Percentage of H_2SiF_6.
1·3162	34·0	1·2285	25·5	1·1466	17·0	1·0704	8·5
3109	33·5	2235	25·0	1419	16·5	0661	8·0
3065	33·0	2186	24·5	1373	16·0	0618	7·5
3003	32·5	2136	24·0	1327	15·5	0576	7·0
2951	32·0	2087	23·5	1281	15·0	0533	6·5
2898	31·5	2038	23·0	1236	14·5	0491	6·0
2846	31·0	1989	22·5	1190	14·0	0449	5·5
2794	30·5	1941	22·0	1145	13·5	0407	5·0
2742	30·0	1892	21·5	1100	13·0	0366	4·5
2691	29·5	1844	21·0	1055	12·5	0324	4·0
2639	29·0	1796	20·5	1011	12·0	0283	3·5
2588	28·5	1748	20·0	0966	11·5	0242	3·0
2537	28·0	1701	19·5	0922	11·0	0201	2·5
2486	27·5	1653	19·0	0878	10·5	0161	2·0
2436	27·0	1606	18·5	0834	10·0	0120	1·5
2385	26·5	1559	18·0	0791	9·5	0080	1·0
2335	26·0	1512	17·5	0747	9·0	0040	0·5

TABLE LXXIIc.—*continued.*

55. Specific Gravity, etc., of Prussic Acid Solutions. (Ure.)

Specific Gravity.	Percentage of HCN.	Specific Gravity.	Percentage of HCN.	Specific Gravity.	Percentage of HCN.
0·9570	16·0	0·9923	5·0	0·9967	2·5
·9768	10·6	·9930	4·6	·9970	2·3
·9815	9·1	·9940	4·0	·9973	2·1
·9840	8·0	·9945	3·6	·9974	2·0
·9870	7·3	·9952	3·2	·9975	1·77
·9890	6·4	·9958	3·0	·9978	1·68
·9900	5·8	·9964	2·7	·9979	1·60
·9914	5·3				

56. Specific Gravity, etc., of Prussic Acid Solutions. (Gerlach.)

Specific Gravity.	Percentage of HCN.	Specific Gravity.	Percentage of HCN.
0·9988	1	0·9895	6
9974	2	9869	7
9958	3	9840	8
9940	4	9811	9
9919	5	9781	10

57. Specific Gravity, etc., of Formic Acid Solutions at 15° C. (Gerlach.)

Specific Gravity.	Percentage of HCOOH.	Specific Gravity.	Percentage of HCOOH.	Specific Gravity.	Percentage of HCOOH.	Specific Gravity.	Percentage of HCOOH.
1·0025	1	1·0200	8	1·0925	35	1·1610	70
0050	2	0225	9	1050	40	1705	75
0075	3	0250	10	1145	45	1800	80
0100	4	0390	15	1240	50	1905	85
0125	5	0530	20	1330	55	2010	90
0150	6	0665	25	1420	60	2120	95
0175	7	0800	30	1515	65	2230	100

TABLE LXXIIc.—*continued.*

58. Specific Gravities, etc., of Acetic Acid Solutions at 15° C. (Oudemans.)

Percent. of CH_3COOH.	Density.	Sp. Gr.	Percent. of CH_3COOH.	Density.	Sp. Gr.	Percent. of CH_3COOH.	Density.	Sp. Gr.
0	0·9992	0·9983	34	1·0459	1·0426	68	1·0725	1·0679
1	1·0007	97	35	70	37	69	29	83
2	22	1·0012	36	81	48	70	33	86
3	37	26	37	92	58	71	37	89
4	52	41	38	1·0502	68	72	40	91
5	67	55	39	13	78	73	42	93
6	83	69	40	23	88	74	44	95
7	98	84	41	33	98	75	46	97
8	1·0113	98	42	43	1·0507	76	47	99
9	27	1·0112	43	52	16	77	48	1·0700
10	42	26	44	62	25	78	48	00
11	57	40	45	71	34	79	48	00
12	71	54	46	80	43	80	48	1·0699
13	85	68	47	89	51	81	47	98
14	1·0200	81	48	98	59	82	46	96
15	14	95	49	1·0607	67	83	44	94
16	28	1·0208	50	15	75	84	42	91
17	42	22	51	23	83	85	39	88
18	56	35	52	31	90	86	36	84
19	70	48	53	38	97	87	31	79
20	84	61	54	46	1·0604	88	26	74
21	98	74	55	53	11	89	20	68
22	1·0311	87	56	60	18	90	13	60
23	24	99	57	66	24	91	05	52
24	37	1·0312	58	73	30	92	1·0696	43
25	50	24	59	79	36	93	86	32
26	63	36	60	85	42	94	74	20
27	75	48	61	91	48	95	60	06
28	88	60	62	97	53	96	44	1·0589
29	1·0400	72	63	1·0702	58	97	25	70
30	12	83	64	07	63	98	04	49
31	24	94	65	12	67	99	1 0580	25
32	36	1·0405	66	17	71	100	53	1·0497
33	47	16	67	21	75			

TABLE LXXIIc.—*continued.*

59. Density, etc., of Acetic Acid Solutions.

Density at 0° C.	Density at 15° C.	Density at 20° C.	Density at 40° C.	Percent. of CH_3COOH.	Density at 0° C.	Density at 15° C.	Density at 20° C.	Density at 40° C.	Percent. of CH_3COOH.
0·9999	0·9992	0·9983	0·9924	**0**	1·0560	1·0470	1·0437	1·0300	**35**
1·0016	1·0007	0·9997	9936	**1**	0573	0481	0448	0308	**36**
0033	0022	1·0012	9948	**2**	0585	0492	0458	0316	**37**
0051	0037	0026	9960	**3**	0598	0502	0468	0324	**38**
0069	0052	0041	9972	**4**	0610	0513	0478	0332	**39**
0088	0067	0055	9984	**5**	0622	0523	0488	0340	**40**
0106	0083	0069	9996	**6**	0634	0533	0498	0348	**41**
0124	0098	0084	1·0008	**7**	0646	0543	0507	0355	**42**
0142	0113	0098	0020	**8**	0657	0552	0516	0363	**43**
0159	0127	0112	0032	**9**	0668	0562	0525	0370	**44**
0176	0142	0126	0044	**10**	0679	0571	0534	0377	**45**
0194	0157	0140	0056	**11**	0690	0580	0543	0384	**46**
0211	0171	0154	0067	**12**	0700	0589	0551	0391	**47**
0228	0185	0168	0079	**13**	0710	0598	0559	0497	**48**
0245	0200	0181	0090	**14**	0720	0607	0567	0404	**49**
0262	0214	0195	0101	**15**	0730	0615	0575	0410	**50**
0279	0228	0208	0112	**16**	0740	0623	0583	0416	**51**
0295	0242	0222	0123	**17**	0749	0631	0590	0423	**52**
0311	0256	0235	0134	**18**	0758	0638	0597	0429	**53**
0327	0270	0248	0144	**19**	0767	0646	0604	0434	**54**
0343	0284	0261	0155	**20**	0775	0653	0611	0440	**55**
0359	0298	0274	0166	**21**	0783	0660	0618	0445	**56**
0374	0311	0287	0176	**22**	0791	0666	0624	0450	**57**
0390	0324	0299	0187	**23**	0798	0673	0630	0455	**58**
0405	0337	0312	0197	**24**	0806	0679	0636	0460	**59**
0420	0350	0324	0207	**25**	0813	0685	0642	0464	**60**
0435	0363	0336	0217	**26**	0820	0691	0648	0468	**61**
0450	0375	0348	0227	**27**	0826	0697	0653	0472	**62**
0465	0388	0360	0236	**28**	0832	0702	0658	0475	**63**
0479	0400	0372	0246	**29**	0838	0707	0663	0479	**64**
0493	0412	0383	0255	**30**	0845	0712	0667	0482	**65**
0507	0424	0394	0264	**31**	0851	0717	0671	0485	**66**
0520	0436	0405	0274	**32**	0856	0721	0675	0488	**67**
0534	0447	0416	0283	**33**	0861	0725	0679	0491	**68**
0547	0459	0426	0291	**34**	0866	0729	0683	0493	**69**

TABLE LXXIIc.—*continued.*

59. Density, etc., of Acetic Acid Solutions.—*continued.*

Density at 0° C.	Density at 15° C.	Density at 20° C.	Density at 40° C.	Percent. of CH_3COOH.	Density at 0° C.	Density at 15° C.	Density at 20° C.	Density at 40° C.	Percent. of CH_3COOH.
1·0871	1·0733	1·0686	1·0495	70	1·0889	1·0736	1·0684	1·0475	86
0875	0737	0689	0497	71	0885	0731	0679	0469	87
0879	0740	0691	0498	72	0881	0726	0674	0462	88
0883	0742	0693	0499	73	0876	0720	0668	0455	89
0886	0744	0695	0500	74	0871	0713	0660	0447	90
0888	0746	0697	0501	75		0705	0652	0438	91
0891	0747	0699	0501	76		0696	0643	0428	92
0893	0748	0700	0501	77		0686	0632	0416	93
0894	0748	0700	0500	78		0674	0620	0403	94
0896	0748	0700	0499	79		0660	0606	0388	95
0897	0748	0699	0497	80		0644	0589	0370	96
0897	0747	0698	0495	81		0625	0570	0350	97
0897	0746	0696	0492	82		0604	0549	0327	98
0896	0744	0694	0489	83		0580	0525	0301	99
0894	0742	0691	0485	84		0553	0497	0273	100
0892	0739	0688	0481	85					

60. Specific Gravity and Volume Percentage of Acetic Acid Solutions at 15° C. (Duclaux.)

Specific Gravity.	Percent. of CH_3COOH by Volume.	Specific Gravity.	Percent. of CH_3COOH by Volume.
1·001	1	1·060	50
004	3	067	60
0075	5	070	70
0155	10	073	80
0275	20	073	90
0410	30	0635	100
0515	40		

TABLE LXXIIc.—*continued.*

61. Specific Gravity, etc., of Arsenic Acid Solutions at 15° C. (E. Kopp.)

I.

Specific Gravity.	Percentage of As_2O_5.	Percentage of H_3AsO_4.	Specific Gravity.	Percentage of As_2O_5.	Percentage of H_3AsO_4.	Specific Gravity.	Percentage of As_2O_5.	Percentage of H_3AsO_4.
1·00	0·00	0·00	1·45	40·55	50·40	1·90	61·85	76·30
05	6·25	7·71	50	43·55	53·70	95	63·50	78·30
10	11·85	14·60	55	46·30	57·10	2·00	65·00	80·20
15	17·05	21·04	60	49·00	60·40	05	66·85	82·50
20	21·80	26·90	65	51·50	63·50	10	68·10	84·07
25	26·15	32·20	70	53·80	66·40	15	70·00	86·40
30	30·15	37·20	75	56·00	69·10	20	71·25	87·90
35	33·85	41·70	80	58·00	71·60	25	72·55	89·50
40	37·30	46·04	85	60·00	74·07	30	73·85	91·10

62. II.

Specific Gravity.	Percentage of As_2O_5.	Percentage of H_3AsO_4.	Specific Gravity.	Percentage of As_2O_5.	Percentage of H_3AsO_4.	Specific Gravity.	Percentage of As_2O_5.	Percentage of H_3AsO_4.
1·0337	4·05	**5**	1·2342	24·30	**30**	1·5320	44·55	**55**
0690	8·10	**10**	2840	28·35	**35**	6086	48·60	**60**
1061	12·15	**15**	3882	32·40	**40**	6919	52·65	**65**
1457	16·20	**20**	3973	36·45	**45**	7827	56·70	**70**
1882	20·25	**25**	4617	40·50	**50**			

63. III. (Schiff.)

Specific Gravity.	Percentage of As_2O_5.	Percentage of H_3AsO_4.
1·7346	54·6	67·4
3973	36·4	45
2350	24·3	30
1606	18·2	22·5
1052	12·2	15·0
0495	6·1	7·5

TABLE LXXIIc.—*continued.*

64. Specific Gravity, etc., of Oxalic Acid Solutions at 15° C. (Franz.)

Specific Gravity.	Percentage of $H_2C_2O_4+2H_2O$.	Specific Gravity.	Percentage of $H_2C_2O_4+2H_2O$.	Specific Gravity.	Percentage of $H_2C_2O_4+2H_2O$.
1·0032	1	1·0182	6	1·0271	10
0064	2	0204	7	0289	10
0096	3	0226	8	0309	12
0128	4	0248	9	0320	12·6
0160	5				

65. Specific Gravity, etc., of Oxalic Acid Solutions at 17°·5 C. (Gerlach.)

Specific Gravity.	Percentage of		Specific Gravity.	Percentage of		Specific Gravity.	Percentage of	
	$H_2C_2O_4+2H_2O$.	$H_2C_2O_4$.		$H_2C_2O_4+2H_2O$.	$H_2C_2O_4$.		$H_2C_2O_4+2H_2O$.	$H_2C_2O_4$.
1·0035	1	0·7142	1·0210	6	4·2852	1·0350	10	7·1420
0070	2	1·4284	0245	7	4·9994	0385	11	7·8562
0105	3	2·1426	0280	8	5·7136	0420	12	8·5704
0140	4	2·8568	0315	9	6·4278	0455	13	9·1285
0175	5	3·5710						

66. Specific Gravity, etc., of Tartaric Acid Solutions at 15° C. (Gerlach.)

Specific Gravity.	Percentage of $C_2H_2(OH)_2(COOH)_2$.	Specific Gravity.	Percentage of $C_2H_2(OH)_2(COOH)_2$.	Specific Gravity.	Percentage of $C_2H_2(OH)_2(COOH)_2$.
1·0045	1	1·0969	20	1·2078	40
0090	2	1072	22	2198	42
0179	4	1175	24	2317	44
0273	6	1282	26	2441	46
0371	8	1393	28	2568	48
0469	10	1505	30	2696	50
0565	12	1615	32	2828	52
0661	14	1726	34	2961	54
0761	16	1840	36	3093	56
0865	18	1959	38	3220	57·9

TABLE LXXIIc.—*continued.*

67. Specific Gravity, etc., of Citric Acid Solutions at 15° C. (Gerlach.)

Specific Gravity.	Percentage of $C_6H_8O_7 + H_2O$.	Specific Gravity.	Percentage of $C_6H_8O_7 + H_2O$.	Specific Gravity.	Percentage of $C_6H_8O_7 + H_2O$.
1·0074	2	1·1060	26	1·2204	50
0149	4	1152	28	2307	52
0227	6	1244	30	2410	54
0309	8	1333	32	2514	56
0392	10	1422	34	2627	58
0470	12	1515	36	2738	60
0549	14	1612	38	2849	62
0632	16	1709	40	2960	64
0718	18	1814	42	3071	66
0805	20	1899	44	3076	66·1
0889	22	1998	46		
0972	24	2103	48		

68. Specific Gravity, etc., of Tannic Acid Solutions at 15° C. (Trammer.)

Specific Gravity.	Percentage of Tannin $C_{14}H_{10}O_9$.	Specific Gravity.	Percentage of Tannin $C_{14}H_{10}O_9$.	Specific Gravity.	Percentage of Tannin $C_{14}H_{10}O_9$.	Specific Gravity.	Percentage of Tannin $C_{14}H_{10}O_9$.
1·0040	1·0	1·0084	2·1	1·0124	3·1	1·0164	4·1
0044	1·1	0088	2·2	0128	3·2	0168	4·2
0048	1·2	0092	2·3	0132	3·3	0172	4·3
0052	1·3	0096	2·4	0136	3·4	0176	4·4
0056	1·4	0100	2·5	0140	3·5	0180	4·5
0060	1·5	0104	2·6	0144	3·6	0184	4·6
0064	1·6	0108	2·7	0148	3·7	0188	4·7
0068	1·7	0112	2·8	0152	3·8	0192	4·8
0072	1·8	0116	2·9	0156	3·9	0196	4·9
0076	1·9	0120	3·0	0160	4·0	0200	5·0
0080	2·0						

69. Specific Gravity, etc., of Ammonium Chloride Solutions at 15° C. (Gerlach.)

Specific Gravity.	Percentage of NH_4Cl.	Specific Gravity.	Percentage of NH_4Cl.	Specific Gravity.	Percentage of NH_4Cl.
1·00316	1	1·03081	10	1·05648	19
00632	2	03370	11	05929	20
00948	3	03658	12	06204	21
01264	4	03947	13	06479	22
01580	5	04325	14	06754	23
01880	6	04524	15	07029	24
02180	7	04805	16	07304	25
02481	8	05086	17	07575	26
02781	9	05367	18	07658	26·297

TABLE LXXIIa.—*continued.*

70. Specific Gravity, etc., of Ammonium Chloride Solutions at 19° C. (Schiff.)

Specific Gravity.	Percentage of NH_4Cl.	Specific Gravity.	Percentage of NH_4Cl.	Specific Gravity.	Percentage of NH_4Cl.	Specific Gravity.	Percentage of NH_4Cl.
1·0029	1	1·0263	9	1·0495	17	1·0714	25
0058	2	0293	10	0523	18	0741	26
0087	3	0322	11	0551	19	0768	27
0116	4	0351	12	0579	20	0794	28
0145	5	0380	13	0606	21	0820	29
0174	6	0409	14	0633	22	0846	30
0203	7	0438	15	0660	23		
0233	8	0467	16	0687	24		

Kohlrausch gives the following:—

5% NH_4Cl, Sp. Gr. 1·0142; 10% NH_4Cl, Sp. Gr. 1·0289; 15% NH_4Cl, Sp. Gr. 1·0430; 20% NH_4Cl, Sp. Gr. 1·0571; and 25% NH_4Cl, Sp. Gr. 1·0710.

71. Specific Gravity, etc., of Lithium Chloride Solutions at 15° C. (Gerlach.)

Specific Gravity.	Percent. of LiCl.	Specific Gravity.	Percent. of LiCl.	Specific Gravity.	Percent. of LiCl.	Specific Gravity.	Percent. of LiCl.
1·006	1	1·064	11	1·124	21	1·189	31
012	2	070	12	130	22	196	32
018	3	076	13	136	23	203	33
024	4	081	14	142	24	210	34
030	5	086	15	148	25	218	35
035	6	093	16	155	26	225	36
040	7	099	17	161	27	232	37
046	8	104	18	168	28	240	38
051	9	110	19	175	29	248	39
058	10	1172	20	1819	30	2557	40

Kohlrausch gives at 15° C.

Percent. of LiCl.	Specific Gravity.
1	1·006
5	030
10	058
15	086
20	117
25	148
30	182
35	219
40	256

72. Specific Gravity, etc., of Sodium Chloride Solutions at 15° C. (Gerlach.)

Specific Gravity.	Percentage of NaCl.	Specific Gravity.	Percentage of NaCl.	Specific Gravity.	Percentage of NaCl.
1·00725	1	1·07335	10	1·14315	19
01450	2	08097	11	15107	20
02174	3	08859	12	15931	21
02899	4	09622	13	16755	22
03624	5	10384	14	17580	23
04366	6	11146	15	18404	24
05108	7	11938	16	19228	25
05851	8	12730	17	20098	26
06593	9	13523	18	20433	26·395

TABLE LXXIIc.—*continued.*

73. Specific Gravity, etc., of Sodium Chloride Solutions at 20° C. (Schiff.)

Sp. Gr.	Pct. of NaCl.	Sp. Gr.	Pct. of NaCl.	Sp. Gr.	Pct. of NaCl.	Sp. Gr.	Pct. of NaCl.	Sp. Gr.	Pct. of NaCl.
1·0066	1	1·0483	7	1·0934	13	1·1408	19	1·1906	25
0133	2	0556	8	1012	14	1490	20	1990	26
0201	3	0630	9	1090	15	1572	21	2075	27
0270	4	0705	10	1168	16	1655	22		
0340	5	0781	11	1247	17	1738	23		
0411	6	0857	12	1327	18	1822	24		

74. Specific Gravity at 0° C. and Maximum Density of NaCl Solutions. (Rosetti.)

Percentage of NaCl.	Sp. Gr. of Solution at 0° C.	Temperature at which Solution attains Maximum Density.	Maximum Density.
0	1·000000	+ 4°	1·000130
0·5	003925	+ 3	003988
1	007634	+ 1·77	007666
2	015366	− 0·58	015367
3	023530	− 3·24	023583
4	030669	− 5·63	030890
6	045975	− 11·07	046952

75. Kohlrausch gives the following for NaCl Solutions at 18° C.

Percentage of NaCl.	Sp. Gr. of Solution.
5	1·0345
10	0707
15	1087
20	1477
25	1898
26	1982
26·4	2014

76. Specific Gravity, etc., of Potassium Chloride Solutions at 15° C. (Gerlach.)

Specific Gravity.	Percentage of KCl.	Specific Gravity.	Percentage of KCl.	Specific Gravity.	Percentage of KCl.
1·00650	1	1·06580	10	1·12179	18
01300	2	07271	11	12849	19
01950	3	07962	12	13608	20
02600	4	08652	13	14348	21
03250	5	09345	14	15088	22
03916	6	10036	15	15828	23
04582	7	10750	16	16568	24
05248	8	11465	17	17234	24·9
05914	9				

TABLE LXXIIc.—*continued.*

77. Specific Gravity, etc., of Potassium Chloride Solutions at 17°·5 C. (Schiff.)

Specific Gravity.	Percentage of KCl.	Specific Gravity.	Percentage of KCl.	Specific Gravity.	Percentage of KCl.
1·0062	1	1·0586	9	1·1152	17
0125	2	0655	10	1225	18
0189	3	0725	11	1298	19
0254	4	0795	12	1372	20
0319	5	0866	13	1446	21
0385	6	0937	14	1521	22
0451	7	1008	15	1597	23
0518	8	1080	16	1673	25

78. Kohlrausch gives the following for KCl Solutions at 18° C.:—

Percent. of KCl.	Specific Gravity.	Percent. of KCl.	Specific Gravity.
5	1·0308	20	1·1335
10	0638	25	1408
15	0978		

79. Specific Gravity, etc., of Rubidium Chloride Solutions. (Tammann.)

Specific Gravity.	Percentage of RbCl.	Wt. of RbCl to each 100 grms. of Water.
1·1066	11·614	13·14
2156	20·559	25·88
2675	24·881	33·13

TABLE LXXIIc.—*continued.*

80. Specific Gravity, etc.,* of Magnesium Chloride Solutions at 24° C. (Schiff.)

Specific Gravity.	Percentage of $MgCl_2 + 6H_2O$.	Percentage of $MgCl_2$.	Specific Gravity.	Percentage of $MgCl_2 + 6H_2O$.	Percentage of $MgCl_2$.
1·0069	2	0·936	1·1519	42	19·656
0138	4	1·872	1598	44	20·592
0207	6	2·808	1677	46	21·528
0276	8	3·744	1756	48	22·464
0345	10	4·680	1836	50	23·400
0415	12	5·616	1918	52	24·336
0485	14	6·552	2000	54	25·272
0556	16	7·488	2083	56	26·208
0627	18	8·424	2167	58	27·144
0698	20	9·360	2252	60	28·080
0770	22	10·296	2338	62	29·016
0842	24	11·232	2425	64	29·952
0915	26	12·168	2513	66	30·888
0988	28	13·104	2602	68	31·824
1062	30	14·040	2692	70	32·760
1137	32	14·976	2783	72	33·696
1212	34	15·912	2875	74	34·632
1288	36	16·848	2968	76	35·568
1364	38	17·784	3063	78	36·504
1441	40	18·720	3159	80	37·440

81. Specific Gravity, etc., of Magnesium Chloride Solutions at 15° C. (Gerlach.)

Sp. Gr.	Pct. of $MgCl_2$.	Sp. Gr.	Pct. of $MgCl_2$.	Sp. Gr.	Pct. of $MgCl_2$.	Sp. Gr.	Pct. of $MgCl_2$.	Sp. Gr.	Pct. of $MgCl_2$.
1·00844	1	1·06844	8	1·13106	15	1·19775	22	1·26897	29
01689	2	07718	9	14045	16	20762	23	27937	30
02533	3	08592	10	14984	17	21750	24	29029	31
03378	4	09495	11	15922	18	22737	25	30121	32
04222	5	10398	12	16861	19	23777	26	31213	33
05096	6	11300	13	17800	20	24817	27	32305	34
05970	7	12203	14	18787	21	25857	28	33397	35

TABLE LXXIIc.—*continued.*

82. Density, etc., of Magnesium Chloride Solutions at 14° C. (Oudemans.)
Water at 14° C.≡0·9993.

Specific Gravity.	Percentage of $MgCl_2+6H_2O$.	Percentage of $MgCl_2$.	Specific Gravity.	Percentage of $MgCl_2+6H_2O$.	Percentage of $MgCl_2$.
1·0033	1	0·4687	1·1018	25	11·7186
0073	2	0·9375	1061	26	12·1873
0113	3	1·4062	1103	27	12·6561
0154	4	1·8750	1146	28	13·1248
0194	5	2·3437	1189	29	13·5936
0234	6	2·8125	1232	30	14·0623
0274	7	3·2812	1275	31	14·5311
0314	8	3·7499	1319	32	14·9998
0355	9	4·2187	1363	33	15·4685
0395	10	4·6874	1407	34	15·9373
0435	11	5·1562	1451	35	16·4060
0476	12	5·6249	1495	36	16·8748
0517	13	6·0937	1540	37	17·3435
0558	14	6·5624	1584	38	17·8123
0599	15	7·0312	1628	39	18·2810
0641	16	7·4999	1673	40	18·7498
0682	17	7·9686	1718	41	19·2185
0724	18	8·4374	1763	42	19·6872
0765	19	8·9061	1809	43	20·1560
0807	20	9·3749	1855	44	20·6247
0849	21	9·8436	1901	45	21·0935
0891	22	10·3124	1948	46	21·5622
0933	23	10·7811	1995	47	22·0310
0976	24	11·2499	2042	48	22·4997

Kohlrausch gives the following for solutions of $MgCl_2$ at 18° C.:—
5% $MgCl_2$, sp. gr. 1·0416; 10% $MgCl_2$, sp. gr. 1·0859; 20% $MgCl_2$, sp. gr. 1·1764; 30% $MgCl_2$, sp. gr. 1·2779; 34% $MgCl_2$, sp. gr. 1·3210.

83. Specific Gravity, etc., of Calcium Chloride Solutions at 15° C. (Gerlach.)

Specific Gravity.	Percent. of $CaCl_2$.	Specific Gravity.	Percent. of $CaCl_2$.	Specific Gravity.	Percent. of $CaCl_2$.	Specific Gravity.	Percent. of $CaCl_2$.
1·00852	1	1·09628	11	1·19251	21	1·29917	31
01704	2	10561	12	20279	22	31045	32
02555	3	11494	13	21308	23	32174	33
03407	4	12427	14	22336	24	33302	34
04259	5	13360	15	23365	25	34430	35
05146	6	14332	16	24450	26	35610	36
06033	7	15305	17	25535	27	36790	37
06921	8	16277	18	26619	28	37970	38
07808	9	17250	19	27704	29	39150	39
08695	10	18222	20	28789	30	40330	40

TABLE LXXIIc.—*continued.*

84. Specific Gravity, etc., of Calcium Chloride Solutions at 18°·3 C. (Schiff.)

Specific Gravity.	Percentage of $CaCl_2 + 6H_2O$.	Percentage of $CaCl_2$.	Specific Gravity.	Percentage of $CaCl_2 + 6H_2O$.	Percentage of $CaCl_2$.
1·0039	1	0·507	1·1575	36	18·245
0079	2	1·014	1622	37	18·752
0119	3	1·521	1671	38	19·259
0159	4	2·028	1719	39	19·766
0200	5	2·534	1768	40	20·272
0241	6	3·041	1816	41	20·779
0282	7	3·548	1865	42	21·286
0323	8	4·055	1914	43	21·793
0365	9	4·562	1963	44	22·300
0407	10	5·068	2012	45	22·806
0449	11	5·575	2062	46	23·313
0491	12	6·082	2112	47	23·820
0534	13	6·587	2162	48	24·327
0577	14	7·096	2212	49	24·834
0619	15	7·601	2262	50	25·340
0663	16	8·107	2312	51	25·847
0706	17	8·611	2363	52	26·354
0750	18	9·121	2414	53	26·861
0794	19	9·625	2465	54	27·368
0838	20	10·136	2516	55	27·874
0882	21	10·643	2567	56	28·381
0927	22	11·150	2618	57	28·888
0972	23	11·657	2669	58	29·395
1017	24	12·164	2721	59	29·902
1062	25	12·670	2773	60	30·408
1107	26	13·177	2825	61	30·915
1153	27	13·684	2877	62	31·422
1199	28	14·191	2929	63	31·929
1246	29	14·698	2981	64	32·436
1292	30	15·204	3034	65	32·942
1339	31	15·711	3087	66	33·449
1386	32	16·218	3140	67	33·956
1433	33	16·725	3193	68	34·463
1480	34	17·232	3246	69	34·970
1527	35	17·738	3300	70	35·476

85. Kohlrausch gives the following for $CaCl_2$ Solutions at 18° C.

Percent. of $CaCl_2$.	Sp. Gr.	Percent. of $CaCl_2$.	Sp. Gr.	Percent. of $CaCl_2$.	Sp. Gr.	Percent. of $CaCl_2$.	Sp. Gr.
5	1·0409	15	1·1311	25	1·2305	35	1·3420
10	0852	20	1794	30	2841		

TABLE LXXIIc.—*continued.*

86. Specific Gravity, etc., of Strontium Chloride Solutions at 15° C. (Gerlach.)

Percent. of Salt.	Specific Gravity.		Percent. of Salt.	Specific Gravity.		Percent. of Salt.	Specific Gravity.	
	$SrCl_2$	$SrCl_2+6H_2O$		$SrCl_2$	$SrCl_2+6H_2O$		$SrCl_2$	$SrCl_2+6H_2O$
1	1·00907	1·005	20	1·19890	1·112	39		1·236
2	01813	012	21	21073	119	40		243
3	02720	017	22	22255	125	41		250
4	03626	023	23	23439	130	42		259
5	04533	028	24	24622	136	43		265
6	05484	033	25	25805	143	44		272
7	06435	038	26	27085	148	45		280
8	07385	043	27	28363	155	46		288
9	08336	048	28	29642	161	47		295
10	09287	054	29	30920	168	48		302
11	10307	060	30	32199	175	49		310
12	11327	066	31	33575	181	50		318
13	12347	072	32	34951	188	51		325
14	13367	078	33	36327	195	52		333
15	14387	083	34		201	53		340
16	15488	090	35		209	54		349
17	16588	095	36		215	55		358
18	17689	100	37		222	56		365
19	18789	106	38		229	57		374

87. Kohlrausch gives the following for $SrCl_2$ Solutions at 18° C.

Percentage of $SrCl_2$.	Sp. Gr.	Percentage of $SrCl_2$.	Sp. Gr.	Percentage of $SrCl_2$.	Sp. Gr.
5	1·0443	15	1·1456	22	1·2259
10	0932	20	2023		

TABLE LXXIIc.—*continued.*

88. Specific Gravity, etc., of Barium Chloride Solutions at 21°·5 C. (Schiff.)

Specific Gravity.	Percentage of $BaCl_2 + 2H_2O$.	Percentage of $BaCl_2$.	Specific Gravity.	Percentage of $BaCl_2 + 2H_2O$.	Percentage of $BaCl_2$.
1·0073	1	0·853	1·1302	16	13·641
0147	2	1·705	1394	17	14·490
0222	3	2·558	1488	18	15·346
0298	4	3·410	1584	19	16·199
0374	5	4·263	1683	20	17·051
0452	6	5·115	1783	21	17·904
0530	7	5·968	1884	22	18·756
0610	8	6·821	1986	23	19·609
0692	9	7·673	2090	24	20·461
0776	10	8·526	2197	25	21·314
0861	11	9 379	2304	26	22·166
0947	12	10·231	2413	27	23·019
1034	13	11·084	2523	28	23·871
1122	14	11·936	2636	29	24·724
1211	15	12·789	2750	30	25·577

89. Specific Gravity, etc., of Barium Chloride Solutions at 15° C. (Gerlach.)

Sp. Gr.	Percent. of $BaCl_2$.	Sp. Gr.	Percent. of $BaCl_2$.	Sp. Gr.	Percent. of $BaCl_2$.	Sp. Gr.	Percent. of $BaCl_2$.	Sp. Gr.	Percent. of $BaCl_2$.
·00917	1	1·05569	6	1·10576	11	1·15999	16	1·21892	21
01834	2	06554	7	11643	12	17152	17	23173	22
02750	3	07538	8	12711	13	18305	18	24455	23
03667	4	08523	9	13778	14	19458	19	25736	24
04584	5	09508	10	14846	15	20611	20	27017	25

90. Kohlrausch gives the following for $BaCl_2$ Solutions at 18° C.

Percentage of $BaCl_2$.	Specific Gravity.
5	1·0445
10	0939
15	1473
20	2047
24	2559

TABLE LXXIIc.—*continued.*

91. Specific Gravity, etc., of Aluminium Chloride Solutions at 15° C. (Gerlach.)

Specific Gravity.	Percentage of Al_2Cl_6.	Specific Gravity.	Percentage of Al_2Cl_6.	Specific Gravity.	Percentage of Al_2Cl_6.	Specific Gravity.	Percentage of Al_2Cl_6.
1·00721	1	1·08902	12	1·17953	23	1·28080	34
01443	2	09684	13	18815	24	29046	35
02164	3	10466	14	19676	25	30066	36
02885	4	11248	15	20584	26	31086	37
03603	5	12073	16	21493	27	32106	38
04353	6	12897	17	22406	28	33126	39
05099	7	13721	18	23310	29	34146	40
05845	8	14545	19	24219	30	35224	41
06591	9	15370	20	25184	31	35359	41·126
07337	10	16231	21	26149	32		
08120	11	17092	22	27115	33		

92. Specific Gravity, etc., of Manganese Chloride Solutions at 15° C. (Gerlach.)

Percentage of Compound.	Specific Gravity corresponding to $MnCl_2 + 4H_2O$.	Specific Gravity corresponding to $MnCl_2$.
5	1·0285	1·045
10	057	091
15	086	138
20	116	189
25	147	245
30	180	306
35	214	372
40	250	443
45	290	514
50	331	
55	375	
60	419	
65	463	
70	508	

TABLE LXXIIc.—*continued.*

93. Specific Gravity, etc., of Ferric Chloride Solutions at 17°·5 C. (Franz.)

Specific Gravity.	Percentage of Fe_2Cl_6.	Specific Gravity.	Percentage of Fe_2Cl_6.	Specific Gravity.	Percentage of Fe_2Cl_6.	Specific Gravity.	Percentage of Fe_2Cl_6.
1·0073	1	1·1297	17	1·2883	33	1·4742	49
0146	2	1378	18	2988	34	4867	50
0219	3	1458	19	3093	35	5010	51
0292	4	1542	20	3199	36	5153	52
0365	5	1644	21	3305	37	5296	53
0439	6	1746	22	3411	38	5439	54
0513	7	1848	23	3517	39	5582	55
0587	8	1950	24	3622	40	5729	56
0661	9	2052	25	3746	41	5876	57
0734	10	2155	26	3870	42	6023	58
0814	11	2258	27	3994	43	6170	59
0894	12	2365	28	4118	44	6317	60
0974	13	2464	29	4242	45		
1054	14	2568	30	4367	46		
1134	15	2673	31	4492	47		
1215	16	2778	32	4617	48		

94. Specific Gravity, etc., of Ferric Chloride Solutions at 17°·5 C. (Hager.)

Specific Gravity.	Percentage of Fe_2Cl_6.	Specific Gravity.	Percentage of Fe_2Cl_6.	Specific Gravity.	Percentage of Fe_2Cl_6.	Specific Gravity.	Percentage of Fe_2Cl_6.
1·008	1	1·140	16	1·304	31	1·494	46
016	2	150	17	316	32	507	47
025	3	160	18	328	33	520	48
033	4	170	19	340	34	533	49
042	5	180	20	352	35	547	50
051	6	191	21	364	36	560	51
060	7	202	22	376	37	573	52
069	8	212	23	390	38	587	53
078	9	223	24	403	39	600	54
087	10	234	25	415	40	612	55
095	11	245	26	428	41	624	56
104	12	256	27	441	42	636	57
113	13	268	28	454	43	648	58
123	14	280	29	469	44	659	59
131	15	292	30	481	45	670	60

95. Specific Gravity, etc., of Ferric Chloride Solutions. (Schult and Gerlach.)

Percentage of Fe_2Cl_6.	Specific Gravity at			
	4°·8 C.	9°·7 C.	14°·6 C.	19°·7 C.
2·70			1·0221	
4·65			0382	
10·45	1·0939	1·0930	0918	1·0901
16·79	1534	1521	1507	1491
22·54	2140	2129	2107	2090
24·60	2351	2334	2318	2298
33·25	3381	3359	3339	3317
36·95		3847	3824	3800
41·00	4413	4387	4361	4335
49·61	5609	5575	5540	5497

TABLE LXXIIc.—*continued.*

96. Specific Gravity, etc., of Cobalt Chloride (and of Nickel Chloride) Solutions at 17°·5 C. (Franz.)

Specific Gravity.	Percentage of $CoCl_2$ or $NiCl_2$.	Specific Gravity.	Percentage of $CoCl_2$ or $NiCl_2$.	Specific Gravity.	Percentage of $CoCl_2$ or $NiCl_2$.	Specific Gravity.	Percentage of $CoCl_2$ or $NiCl_2$.
1·0099	1	1·0795	8	1·1460	14	1·2245	20
0198	2	0895	9	1579	15	2396	21
0297	3	0997	10	1711	16	2547	22
0396	4	1112	11	1844	17	2698	23
0496	5	1228	12	1977	18	2849	24
0595	6	1344	13	2110	19	3002	25
0695	7						

97. Specific Gravity, etc., of Cupric Chloride Solutions at 17°·5 C. (Franz.)

Specific Gravity.	Percentage of $CuCl_2$.	Specific Gravity.	Percentage of $CuCl_2$.	Specific Gravity.	Percentage of $CuCl_2$.	Specific Gravity.	Percentage of $CuCl_2$.
1·0091	1	1·1049	11	1·2362	21	1·3784	31
0182	2	1178	12	2501	22	3950	32
0273	3	1307	13	2640	23	4116	33
0364	4	1436	14	2779	24	4287	34
0455	5	1565	15	2918	25	4447	35
0548	6	1696	16	3058	26	4615	36
0641	7	1827	17	3198	27	4782	37
0734	8	1958	18	3338	28	4949	38
0827	9	2089	19	3478	29	5116	39
0920	10	2223	20	3618	30	5284	40

98. Specific Gravity, etc., of Zinc Chloride Solutions at 19°·5 C. (Kremers.)

Specific Gravity.	Percentage of $ZnCl_2$.	Specific Gravity.	Percentage of $ZnCl_2$.	Specific Gravity.	Percentage of $ZnCl_2$.	Specific Gravity.	Percentage of $ZnCl_2$.
1·010	1	1·146	16	1·304	31	1·500	46
020	2	155	17	316	32	518	47
029	3	165	18	329	33	533	48
037	4	175	19	340	34	550	49
045	5	186	20	352	35	566	50
053	6	196	21	366	36	581	51
063	7	207	22	380	37	600	52
072	8	218	23	392	38	615	53
082	9	228	24	406	39	631	54
091	10	238	25	420	40	650	55
100	11	249	26	432	41	669	56
110	12	260	27	446	42	686	57
120	13	270	28	460	43	704	58
128	14	281	29	473	44	724	59
137	15	291	30	488	45	740	60

TABLE LXXIIc.—*continued.*

99. Specific Gravity, etc., of Cadmium Chloride Solutions at 19°·5 C. (Kremers and Gerlach.)

Specific Gravity.	Percent. $CdCl_2$.	Specific Gravity.	Percent. $CdCl_2$.
1·045	5	1·472	40
089	10	656	50
195	20	890	60
321	30		

100. Specific Gravity, etc., of Stannous Chloride Solutions at 15° C. (Gerlach.)

Specific Gravity.	Percentage of $SnCl_2+2H_2O$.	Specific Gravity.	Percentage of $SnCl_2+2H_2O$.	Specific Gravity.	Percentage of $SnCl_2+2H_2O$.
1·007	1	1·203	27	1·484	53
013	2	212	28	497	54
020	3	221	29	5106	55
026	4	2300	30	525	56
0331	5	240	31	539	57
040	6	249	32	554	58
047	7	259	33	568	59
054	8	268	34	5823	60
061	9	2779	35	598	61
0684	10	288	36	613	62
076	11	299	37	629	63
083	12	309	38	644	64
090	13	319	39	6598	65
097	14	3298	40	677	66
1050	15	341	41	694	67
113	16	352	42	711	68
121	17	363	43	728	69
128	18	374	44	7452	70
136	19	3850	45	764	71
1442	20	397	46	783	72
152	21	409	47	802	73
161	22	421	48	821	74
169	23	433	49		
177	24	4451	50	840	75
1855	25	458	51		
194	26	471	52		

TABLE LXXIIc.—*continued.*

101. Specific Gravity, etc., of Stannic Chloride Solutions at 15° C. (Gerlach.)

Specific Gravity.	Percentage of $SnCl_4+5H_2O$.	Specific Gravity.	Percentage of $SnCl_4+5H_2O$.	Specific Gravity.	Percentage of $SnCl_4+5H_2O$.
1·006	1	1·218	33	1·5255	65
012	2	2268	34	538	66
018	3	233	35	550	67
024	4	242	36	563	68
0298	5	250	37	575	69
036	6	259	38	5873	70
042	7	267	39	601	71
048	8	2755	40	614	72
053	9	284	41	627	73
0593	10	293	42	641	74
066	11	302	43	6543	75
072	12	310	44	669	76
078	13	3193	45	683	77
084	14	329	46	698	78
0905	15	338	47	712	79
097	16	347	48	7271	80
104	17	357	49	743	81
110	18	3661	50	759	82
117	19	376	51	775	83
1236	20	386	52	791	84
130	21	396	53	8067	85
137	22	406	54	824	86
144	23	4154	55	842	87
151	24	426	56	859	88
1581	25	437	57	876	89
165	26	447	58	8939	90
173	27	458	59	913	91
180	28	4684	60	932	92
187	29	480	61	950	93
1947	30	491	62	969	94
202	31	503	63		
210	32	514	64	9881	95

TABLE LXXIIc.—*continued.*

102. Density, etc., of Mercuric Chloride Solutions at 20° C. (Schröder, etc.)

Specific Gravity.	Percent. of $HgCl_2$.	Specific Gravity.	Percent. of $HgCl_2$.	Specific Gravity.	Percent. of $HgCl_2$.	Specific Gravity.	Percent. of $HgCl_2$.
1·0072	1	1·0411	5	1·0710	8	1·1035	11
0148	2	0507	6	0815	9	115	12
0236	3	0615	7	095	10	127	13
0323	4						

103. Specific Gravity, etc., of Platinic Chloride Solutions. (Precht.)

Specific Gravity.	Percentage of $PtCl_4$.	Specific Gravity.	Percentage of $PtCl_4$.	Specific Gravity.	Percentage of $PtCl_4$.	Specific Gravity.	Percentage of $PtCl_4$.
1·009	1	1·141	14	1·315	27	1·546	40
018	2	153	15	330	28	568	41
027	3	165	16	346	29	591	42
036	4	176	17	362	30	615	43
046	5	188	18	387	31	641	44
056	6	201	19	395	32	666	45
066	7	214	20	413	33	688	46
076	8	227	21	431	34	712	47
086	9	242	22	450	35	736	48
097	10	256	23	469	36	760	49
108	11	270	24	488	37	785	50
119	12	285	25	500	38		
130	13	300	26	523	39		

104. Specific Gravity, etc., of Solutions of Bromides of various Metals at 19°·5 C. (Kremers.)

Percentage of Salt.	Specific Gravity for Solutions of								
	LiBr.	NaBr.	KBr.	$MgBr_2$.	$CaBr_2$.	$SrBr_2$.	$BaBr_2$.	$ZnBr_2$.	$CdBr_2$.
5	1·035	1·040	1·037	1·043	1·044	1·046	1·045	1·045	1·043
10	072	080	075	087	089	094	092	093	090
15	113	125	116	137	139	146	144	146	141
20	156	174	159	191	194	204	201	204	199
25	204	226	207	247	252	266	262	265	260
30	254	281	256	310	315	332	329	330	326
35	309	344	309	377	385	410	405	400	400
40	368	410	366	451	461	492	485	475	481
45	432	483	432	535	549	590	580	560	578
50	500	565		625	611	694	685	650	680
55	580						800	755	
60								875	

TABLE LXXIIc.—*continued.*

105. Specific Gravity, etc., of Ammonium Bromide Solutions at 16° C. (Hager.)

Percentage of NH_4Br	Sp. Gr.	Percentage of NH_4Br.	Sp. Gr.	Percentage of NH_4Br.	Sp. Gr.
2	1·0119	15	1·0926	28	1·1787
3	0181	16	0988	29	1862
4	0242	17	1051	30	1938
5	0303	18	1115	31	2018
6	0364	19	1181	32	2098
7	0425	20	1246	33	2180
8	0486	21	1310	34	2260
9	0547	22	1375	35	2342
10	0609	23	1440	36	2425
11	0672	24	1506	37	2509
12	0735	25	1573	38	2594
13	0798	26	1642	39	2679
14	0862	27	1713	40	2765
				41	2850

At 15° C. (Eder.)

Percentage of NH_4Br.	Sp. Gr.
5	1·0326
10	0652
15	0960
20	1285
30	1921
41·09	2920

106. Specific Gravity, etc., of Solutions of the Iodides of various Metals at 19°·5 C. (Kremers.)

Percentage of Salt.	Specific Gravity for Solutions of								
	LiI.	NaI.	KI.	MgI_2.	CaI_2.	SrI_2.	BaI_2.	ZnI_2.	CdI_2.
5	1·038	1·040	1·038	1·043	1·044	1·045	1·045	1·045	1·044
10	079	082	078	088	090	091	091	091	088
15	124	128	120	139	140	142	143	140	138
20	172	179	166	194	198	200	201	196	194
25	224	234	218	254	260	262	265	255	253
30	280	294	271	320	321	330	333	368	319
35	344	360	331	395	398	410	412	390	395
40	414	432	396	474	477	491	495	420	476
45	489	510	469	568	567	590	596	560	575
50	575	600	546	668	665	695	704	650	680
55	670	700	636	780	780	812	825	754	
60	777	810	734	915	910	955	970	875	
65						2·150		2·020	
70								180	
75								360	

Kohlrausch gives the following numbers at 18° C.:—

For NH_4I, 10%=Sp. Gr. 1·0652; 20%=1·1397; 30%=1·2260; 40%=1·3260; 50%=1·4415.

For KI; 5%=1·0363; 10%=1·0762; 20%=1·1679; 30%=1·273; 40%=1·3966; 50%=1·545; 55%=1·630.

TABLE LXXIIc.—*continued.*

107. Specific Gravity, etc., of Potassium Iodide Solutions at 21° C. (Schiff.)

Percentage of KI.	Specific Gravity.	Percentage of KI.	Specific Gravity.	Percentage of KI.	Specific Gravity.	Percentage of KI.	Specific Gravity.
1	1·0075	16	1·1318	31	1·2899	46	1·4982
2	0151	17	1412	32	3017	47	5142
3	0227	18	1508	33	3138	48	5305
4	0305	19	1605	34	3262	49	5471
5	0384	20	1705	35	3389	50	5640
6	0464	21	1807	36	3519	51	5810
7	0545	22	1911	37	3653	52	5984
8	0627	23	2016	38	3791	53	6162
9	0710	24	2122	39	3933	54	6343
10	0793	25	2229	40	4079	55	6528
11	0877	26	2336	41	4224	56	6717
12	0962	27	2445	42	4371	57	6911
13	1048	28	2556	43	4520	58	7109
14	1136	29	2669	44	4671	59	7311
15	1226	30	2784	45	4825	60	7517

108. Specific Gravity, etc., of Potassium Iodide Solutions at 18° C. (Kohlrausch.)

Percentage of KI.	Specific Gravity.	Percentage of KI.	Specific Gravity.
5	1·0363	40	1·3966
10	0762	50	545
20	1679	55	630
30	273		

109. Specific Gravity, etc., of Potassium Cyanide Solutions at 15° C. (Kohlrausch.)

Specific Gravity.	Percentage of KCN.
1·0154	3·25
0316	6·5

110. Specific Gravity, etc., of Potassium Ferrocyanide Solutions at 15° C. (Schiff.)

Specific Gravity.	Percentage of		Specific Gravity.	Percentage of	
	$K_4Fe(CN)_6+3H_2O$.	$K_4Fe(CN)_6$.		$K_4Fe(CN)_6+3H_2O$.	$K_4Fe(CN)_6$.
1·0058	1	0·872	1·0669	11	9·592
0116	2	1·744	0734	12	10·464
0175	3	2·616	0800	13	11·336
0234	4	3·488	0860	14	12·208
0295	5	4·360	0932	15	13·080
0356	6	5·232	0999	16	13·952
0417	7	6·104	1067	17	14·824
0479	8	6·976	1136	18	15·696
0542	9	7·848	1205	19	16·568
0605	10	8·720	1275	20	17·440

TABLE LXXIIc.—*continued.*

111. Specific Gravity, etc., of Potassium Ferricyanide Solutions at 13° C. (Schiff.)

Percentage of $K_6Fe_2(CN)_{12}$.	Specific Gravity.	Percentage of $K_6Fe_2(CN)_{12}$.	Specific Gravity.	Percentage of $K_6Fe_2(CN)_{12}$.	Specific Gravity.
1	1·0051	11	1·0595	21	1·1202
2	0103	12	0653	22	1266
3	0155	13	0712	23	1331
4	0208	14	0771	24	1396
5	0261	15	0831	25	1462
6	0315	16	0891	26	1529
7	0370	17	0952	27	1596
8	0426	18	1014	28	1664
9	0482	19	1076	29	1732
10	0538	20	1139	30	1802

112. Specific Gravity, etc., of Ammonium Nitrate Solutions at 17°·5 C. (Gerlach.)

Specific Gravity.	Percentage of NH_4NO_3.	Specific Gravity.	Percentage of NH_4NO_3.	Specific Gravity.	Percentage of NH_4NO_3.
1·0042	1	1·0995	23	1·2045	45
0085	2	1040	24	2096	46
0127	3	1085	25	2147	47
0170	4	1130	26	2198	48
0212	5	1175	27	2249	49
0255	6	1220	28	2300	50
0297	7	1265	29	2353	51
0340	8	1310	30	2407	52
0382	9	1358	31	2460	53
0425	10	1406	32	2514	54
0468	11	1454	33	2567	55
0512	12	1502	34	2621	56
0555	13	1550	35	2674	57
0599	14	1598	36	2728	58
0642	15	1646	37	2781	59
0686	16	1694	38	2835	60
0729	17	1742	39	2888	61
0773	18	1790	40	2942	62
0816	19	1841	41	3005	63
0860	20	1892	42	3059	64
0905	21	1942	43		
0950	22	1994	44		

TABLE LXXIIc.—*continued.*

113. Specific Gravity, etc., of Lithium Nitrate Solutions at 19°·5 C. (Kremers.)

Specific Gravity.	Percentage of $LiNO_3$.	Specific Gravity.	Percentage of $LiNO_3$.
1·069	12·7	1·245	54·8
077	14·2	255	57·5
134	26·4	315	77·4
197	41·8	319	79·4

114. Specific Gravity, etc., of Sodium Nitrate Solutions at 20°·2 C. (Schiff.)

Specific Gravity.	Percentage of $NaNO_3$.	Specific Gravity.	Percentage of $NaNO_3$.	Specific Gravity.	Percentage of $NaNO_3$.	Specific Gravity.	Percentage of $NaNO_3$.
1·0065	1	1·0962	14	1·1987	27	1·3155	40
0131	2	1035	15	2070	28	3255	41
0197	3	1109	16	2154	29	3355	42
0264	4	1184	17	2239	30	3456	43
0332	5	1260	18	2325	31	3557	44
0399	6	1338	19	2412	32	3659	45
0468	7	1418	20	2500	33	3761	46
0537	8	1498	21	2589	34	3864	47
0606	9	1578	22	2679	35	3968	48
0676	10	1659	23	2770	36	4074	49
0746	11	1740	24	2863	37	4180	50
0817	12	1822	25	2958	38		
0889	13	1904	26	3055	39		

115. Kohlrausch gives the following for $NaNO_3$ Solutions at 18° C.

5 % $NaNO_3$≡Sp. Gr. 1·0327	20 % $NaNO_3$≡Sp. Gr. 1·1435
10 % ,, ,, 1·0681	30 % ,, ,, 1·2278

116. Specific Gravity, etc., of Potassium Nitrate Solutions at 21°. (Schiff.)

Specific Gravity.	Percentage of KNO_3.	Specific Gravity.	Percentage of KNO_3.	Specific Gravity.	Percentage of KNO_3.
1·0058	1	1·0555	9	1·1097	17
0118	2	0621	10	1160	18
0178	3	0686	11	1242	19
0239	4	0752	12	1316	20
0300	5	0819	13	1390	21
0363	6	0887	14	1464	22
0425	7	0956	15	1539	23
0490	8	1026	16	1613	24

TABLE LXXIIc.—*continued.*

117. Specific Gravity, etc., of Potassium Nitrate Solutions at 15° C. (Gerlach.)

Specific Gravity.	Percentage of KNO_3.	Specific Gravity.	Percentage of KNO_3.	Specific Gravity.	Percentage of KNO_3.
1·00641	1	1·05861	9	1·11426	17
01283	2	06224	10	12150	18
01924	3	07215	11	12875	19
02566	4	07905	12	13599	20
03207	5	08595	13	14361	21
03870	6	09286	14	14427	21·074
04534	7	09977	15		
05197	8	10701	16		

118. Specific Gravity, etc., of Potassium Nitrate Solutions at 17°·5 C. (Hager.)

Specific Gravity.	Percentage of KNO_3.	Specific Gravity.	Percentage of KNO_3.	Specific Gravity.	Percentage of KNO_3.	Specific Gravity.	Percentage of KNO_3.
1·006	1	1·038	6	1·072	11	1·106	16
012	2	045	7	078	12	113	17
019	3	051	8	085	13	120	18
025	4	058	9	092	14	127	19
032	5	065	10	099	15	134	20

119. Kohlrausch gives at 18° C.

Percentage of KNO_3.	Specific Gravity.
5	1·0305
10	0632
15	097
20	133
22	148

TABLE LXXIIc.—*continued.*

120. Specific Gravity, etc., of Magnesium Nitrate Solutions at 14° C. (Oudemans.)

Specific Gravity.	Percentage of		Specific Gravity.	Percentage of		Specific Gravity.	Percentage of	
	$Mg(NO_3)_2 + 6H_2O$.	$Mg(NO_3)_2$.		$Mg(NO_3)_2 + 6H_2O$.	$Mg(NO_3)_2$.		$Mg(NO_3)_2 + 6H_2O$.	$Mg(NO_3)_2$.
1·0034	1	0·5773	1·0869	20	11·5460	1·1909	40	23·0920
0202	5	2·8865	1103	25	14·4325	2176	45	25·9785
0418	10	5·773	1347	30	17·319	2397	49	28·2877
0639	15	8·6595	1649	35	20·2055			

121. Specific Gravity, etc., of Magnesium Nitrate Solutions at 21° C. (Schiff.)

Specific Gravity.	Percentage of		Specific Gravity.	Percentage of		Specific Gravity.	Percentage of	
	$Mg(NO_3)_2 + 6H_2O$.	$Mg(NO_3)_2$.		$Mg(NO_3)_2 + 6H_2O$.	$Mg(NO_3)_2$.		$Mg(NO_3)_2 + 6H_2O$.	$Mg(NO_3)_2$.
1·0078	2	1·156	1·0843	20	11·560	1·1709	38	21·972
0158	4	2·312	0934	22	12·716	1811	40	22·128
0239	6	3·468	1026	24	13·872	1914	42	23·284
0321	8	4·624	1120	26	15·028	2019	44	24·440
0405	10	5·780	1216	28	16·184	2124	46	25·596
0490	12	6·936	1312	30	17·348	2231	48	26·750
0577	14	8·092	1410	32	18·504	2340	50	27·900
0663	16	9·248	1508	34	19·660			
0752	18	10·404	1608	36	20·816			

Kohlrausch gives the following for $Mg(NO_3)_2$ Solutions at 18° C. :—

5 % $Mg(NO_3)_2$≡Sp. Gr. 1·0378 | 15 % $Mg(NO_3)_2$≡Sp. Gr. 1·1181
10 % „ „ 1·0763 | 17 % „ „ 1·1372

122. Specific Gravity, etc., of Calcium Nitrate Solutions at 17°·5 C. (Franz.)

Specific Gravity.	Percentage of $Ca(NO_3)_2$.	Specific Gravity.	Percentage of $Ca(NO_3)_2$.
1·009	1	1·328	35
045	5	385	40
086	10	447	45
129	15	515	50
174	20	588	55
222	25	666	60
272	30		

TABLE LXXIIc.—*continued.*

123. Kohlrausch gives the following for $Ca(NO_3)_2$ Solutions at 18° C.

6·25 %	$Ca(NO_3)_2$	≡Sp.	Gr.	1·0487
12·5	,,	,,	,,	1·1016
25	,,	,,	,,	1·2198
37·5	,,	,,	,,	1·3546
50	,,	,,	,,	1·5102

124. Specific Gravity, etc., of Calcium Nitrate Solutions at 17°·5 C. (Gerlach.)

Specific Gravity.	Percentage of $Ca(NO_3)_2$.	Percentage of $Ca(NO_3)_2+2H_2O$.	Specific Gravity.	Percentage of $Ca(NO_3)_2$.	Percentage of $Ca(NO_3)_2+2H_2O$.
1·000	0	0	1·272	32·8	40
059	8·2	10	355	41·0	50
124	16·4	20	445	49·2	60
195	24·6	30			

125. Specific Gravity, etc., of Calcium Nitrate Solutions at 15° C.

Specific Gravity.	Pct. $Ca(NO_3)_2$.	Specific Gravity.	Pct. $Ca(NO_3)_2$.	Specific Gravity.	Pct. $Ca(NO_3)_2$.
1·008	1	1·173	21	1·379	41
015	2	183	22	391	42
023	3	192	23	402	43
030	4	202	24	414	44
038	5	212	25	425	45
046	6	222	26	437	46
053	7	232	27	448	47
061	8	241	28	460	48
068	9	251	29	471	49
076	10	261	30	483	50
085	11	271	31	495	51
093	12	282	32	507	52
102	13	293	33	520	53
111	14	304	34	532	54
119	15	314	35	544	55
128	16	325	36	556	56
137	17	336	37	568	57
146	18	347	38	581	58
154	19	357	39	593	59
163	20	368	40	605	60

TABLE LXXIIc.—*continued.*

126. Specific Gravity, etc., of Strontium Nitrate Solutions at 19°·5 C. (Kremers.)

Specific Gravity.	Percentage of $Sr(NO_3)_2$.
1·009	1
017	2
025	3
034	4
041	5
049	6
059	7
068	8
076	9
085	10
095	11
103	12
113	13
122	14
131	15
140	16
150	17
160	18
170	19
181	20
192	21
202	22
213	23
223	24
235	25
246	26
257	27
268	28
280	29
292	30
304	31
316	32
330	33
340	34
354	35
367	36
381	37
395	38
410	39
422	40

127. Specific Gravity, etc., of Strontium Nitrate Solutions at 17°·5 C. (Gerlach.)

Specific Gravity.	Percentage of $Sr(NO_3)_2$.
1·083	10
180	20
294	30
422	40
52	Sat.

128. Specific Gravity, etc., of Barium Nitrate Solutions at 19°·5 C. (Kremers.)

Specific Gravity.	Percentage of $Ba(NO_3)_2$.
1·009	1
017	2
025	3
037	4
042	5
050	6
060	7
069	8
078	9
087	10

129. Specific Gravity, etc., of Barium Nitrate Solutions at 17°·5 C. (Gerlach.)

Specific Gravity.	Percentage of $Ba(NO_3)_2$.
1·0085	1
0170	2
0255	3
0340	4
0425	5
0510	6
0600	7
0690	8 Sat.

TABLE LXXIIc.—*continued.*

130. Kohlrausch gives the following for $Ba(NO_3)_2$ Solutions at 18° C

Percentage $Ba(NO_3)_2$.	Specific Gravity.
4·2	1·0340
8·4	0712

131 Specific Gravity, etc., of Ferric Nitrate Solutions at 17°·5 C. (Franz.)

Specific Gravity.	Percentage of $Fe_2(NO_3)_6$.	Specific Gravity.	Percentage of $Fe_2(NO_3)_6$.	Specific Gravity.	Percentage of $Fe_2(NO_3)_6$.	Specific Gravity.	Percentage of $Fe_2(NO_3)_6$.
1·0080	1	1·1440	18	1·3164	35	1·5272	52
0160	2	1526	19	3280	36	5422	53
0240	3	1612	20	3396	37	5572	54
0320	4	1712	21	3512	38	5722	55
0398	5	1812	22	3628	39	5892	56
0472	6	1912	23	3746	40	6062	57
0546	7	2012	24	3864	41	6232	58
0620	8	2110	25	3982	42	6402	59
0694	9	2212	26	4100	43	6572	60
0770	10	2314	27	4218	44	6764	61
0852	11	2416	28	4338	45	6956	62
0934	12	2518	29	4465	46	7148	63
1016	13	2622	30	4592	47	7340	64
1098	14	2730	31	4719	48	7532	65
1182	15	2838	32	4846	49		
1268	16	2946	33	4972	50		
1354	17	3054	34	5122	51		

132. Specific Gravity, etc., of Solutions of the Nitrates of Cobalt and Nickel at 17°·5 C. (Franz.)

Percentage of Salt.	Specific Gravity for		Percentage of Salt.	Specific Gravity for		Percentage of Salt.	Specific Gravity for	
	$Co(NO_3)_2$.	$Ni(NO_3)_2$.		$Co(NO_3)_2$.	$Ni(NO_3)_2$.		$Co(NO_3)_2$.	$Ni(NO_3)_2$
1	1·0092	1·0092	15	1·1378	1·1375	29	1·3058	1·3058
2	0184	0184	16	1490	1490	30	3190	3193
3	0276	0276	17	1602	1602	31	3331	3331
4	0368	0368	18	1714	1714	32	3472	3472
5	0462	0463	19	1826	1826	33	3613	3613
6	0551	0551	20	1936	1935	34	3754	3754
7	0640	0640	21	2056	2056	35	3896	3896
8	0729	0729	22	2176	2176	36	4049	4049
9	0818	0818	23	2296	2296	37	4202	4202
10	0906	0903	24	2416	2416	38	4355	4356
11	1000	0999	25	2538	2534	39	4508	4509
12	1094	1094	26	2668	2668	40	4662	4662
13	1188	1188	27	2798	2798			
14	1282	1282	28	2928	2928			

TABLE LXXIIc.—*continued.*

133. Specific Gravity, etc., of Copper Nitrate Solutions at 17°·5 C. (Franz.)

Specific Gravity.	Percentage of $Cu(NO_3)_2$.	Specific Gravity.	Percentage of $Cu(NO_3)_2$.	Specific Gravity.	Percentage of $Cu(NO_3)_2$.	Specific Gravity.	Percentage of $Cu(NO_3)_2$.
1·0090	1	1·1242	13	1·2644	25	1·4274	37
0180	2	1342	14	2775	26	4424	38
0270	3	1442	15	2906	27	4574	39
0360	4	1561	16	3057	28	4724	40
0452	5	1680	17	3168	29	4894	41
0550	6	1799	18	3299	30	5064	42
0648	7	1918	19	3432	31	5234	43
0746	8	2037	20	3575	32	5404	44
0844	9	2158	21	3708	33	5576	45
0942	10	2279	22	3841	34		
1042	11	2400	23	3974	35		
1142	12	2521	24	4124	36		

134. Specific Gravity, etc., of Solutions of the Nitrates of Zinc and Cadmium at 17°·5 C. (Franz.)

Percentage of Salt.	Specific Gravity for		Percentage of Salt.	Specific Gravity for		Percentage of Salt.	Specific Gravity for	
	$Zn(NO_3)_2$.	$Cd(NO_3)_2$.		$Zn(NO_3)_2$.	$Cd(NO_3)_2$.		$Zn(NO_3)_2$.	$Cd(NO_3)_2$.
1	1·0099	1·0106	18	1·1806	1·1888	35	1·3906	1·4372
2	0198	0212	19	1916	2012	36	4039	4572
3	0297	0318	20	2024	2134	37	4172	4772
4	0396	0424	21	2147	2276	38	4305	4972
5	0496	0528	22	2270	2418	39	4438	5172
6	0590	0618	23	2393	2560	40	4572	5372
7	0684	0708	24	2516	2702	41	4707	5592
8	0778	0798	25	2640	2842	42	4844	5812
9	0872	0888	26	2766	2987	43	4981	6032
10	0968	0978	27	2892	3132	44	5118	6252
11	1070	1086	28	3018	3277	45	5258	6474
12	1172	1194	29	3144	3422	46	5403	6701
13	1274	1302	30	3268	3566	47	5548	6928
14	1376	1410	31	3396	3728	48	5693	7155
15	1476	1516	32	3524	3890	49	5838	7382
16	1586	1640	33	3652	4052	50	5984	7608
17	1696	1764	34	3780	4214			

TABLE LXXIIc.—*continued.*

135. Specific Gravity, etc., of Silver Nitrate Solutions at 18° C. (Kohlrausch.)

Specific Gravity.	Percentage $AgNO_3$.	Specific Gravity.	Percentage $AgNO_3$.	Specific Gravity.	Percentage $AgNO_3$.
1·0422	5	1·2555	25	1·5705	45
0893	10	3213	30	6745	50
1404	15	3945	35	7895	55
1958	20	4773	40	9158	60

136. Specific Gravity, etc., of Solutions of Lead Nitrate at 17°·5 C. (Schiff.)

Specific Gravity.	Percent. $Pb(NO_3)_2$	Specific Gravity.	Percent. $Pb(NO_3)_2$	Specific Gravity.	Percent. $Pb(NO_3)_2$	Specific Gravity.	Percent. $Pb(NO_3)_2$	Specific Gravity.	Percent. $Pb(NO_3)_2$
1·0080	1	1·0775	9	1·1569	17	1·2495	25	1·3558	33
0163	2	0869	10	1677	18	2620	26	3702	34
0247	3	0963	11	1788	19	2747	27	3848	35
0331	4	1059	12	1902	20	2876	28	3996	36
0416	5	1157	13	2016	21	3007	29	4146	37
0502	6	1257	14	2132	22	3140	30		
0591	7	1359	15	2251	23	3276	31		
0682	8	1463	16	2372	24	3416	32		

137. Specific Gravity, etc., of Lead Nitrate Solutions at 19°·5 C. (Kremers.)

Sp. Gr., ...	1·045	1·093	1·144	1·203	1·266	1·334	1·414
Pct. $Pb(NO_3)_2$., . .	5	10	15	20	25	30	35

138. Specific Gravity, etc., of Sodium Chlorate Solutions at 19°·5 C. (Kremers.)

Specific Gravity.	Pct. of $NaClO_3$.	Specific Gravity.	Pct. of $NaClO_3$.	Specific Gravity.	Pct. of $NaClO_3$.	Specific Gravity.	Pct. of $NaClO_3$.	Specific Gravity.	Pct. of $NaClO_3$.
1·007	1	1·063	9	1·124	17	1·190	25	1·262	33
015	2	070	10	131	18	200	26	272	34
021	3	078	11	140	19	208	27	282	35
028	4	085	12	147	20	216	28	291	36
035	5	094	13	155	21	225	29	301	37
041	6	100	14	165	22	235	30	311	38
048	7	108	15	174	23	244	31	321	39
055	8	116	16	181	24	252	32	331	40

TABLE LXXIIc.—*continued.*

139. Specific Gravity, etc., of Potassium Chlorate Solutions at 19°·5 C. (Kremers.)

Specific Gravity.	Percent. $KClO_3$.	Specific Gravity.	Percent. $KClO_3$.	Specific Gravity.	Percent. $KClO_3$.	Specific Gravity.	Percent. $KClO_3$.	Specific Gravity.	Percent. $KClO_3$.
1·007	1	1·020	3	1·033	5	1·045	7	1·059	9
1·014	2	1·026	4	1·039	6	1·052	8	1·066	10

140. Specific Gravity, etc., of Sodium Bromate Solutions at 19°·5 C. (Kremers.)

Specific Gravity.	Pct. of $NaBrO_3$.	Specific Gravity.	Pct. of $NaBrO_3$.	Specific Gravity.	Pct. of $NaBrO_3$.	Specific Gravity.	Pct. of $NaBrO_3$.	Specific Gravity.	Pct. of $NaBrO_3$.
1·009	1	1·056	7	1·110	13	1·166	19	1·231	25
016	2	066	8	120	14	178	20	242	26
025	3	075	9	129	15	188	21	253	27
033	4	083	10	137	16	199	22	265	28
041	5	093	11	146	17	210	23	277	29
049	6	101	12	156	18	220	24	289	30

141. Specific Gravity, etc., of Potassium Bromate Solutions at 19°·5 C. (Kremers.)

Specific Gravity.	Percent. $KBrO_3$.	Specific Gravity.	Percent. $KBrO_3$.	Specific Gravity.	Percent. $KBrO_3$.	Specific Gravity.	Percent. $KBrO_3$.	Specific Gravity.	Percent. $KBrO_3$.
1·009	1	1·024	3	1·039	5	1·054	7	1·070	9
1·016	2	1·031	4	1·046	6	1·062	8	1·079	10

142. Specific Gravity, etc., of Solutions of the Iodates of Sodium and Potassium at 19°·5 C. (Kremers.)

Percentage.	Specific Gravity for		Percentage.	Specific Gravity for	
	$NaIO_3$.	KIO_3.		$NaIO_3$.	KIO_3.
1	1·010	1·010	6	1·054	1·052
2	019	019	7	065	061
3	028	027	8	075	071
4	036	035	9	085	080
5	044	044	10	095	090

TABLE LXXIIc.—*continued.*

143. Specific Gravity, etc., of Ammonium Sulphate Solutions at 19° C. (Schiff.)

Specific Gravity.	Percentage of $(NH_4)_2SO_4$.	Specific Gravity.	Percentage of $(NH_4)_2SO_4$.	Specific Gravity.	Percentage of $(NH_4)_2SO_4$.
1·0057	1	1·1035	18	1·2004	35
0115	2	1092	19	2060	36
0172	3	1149	20	2116	37
0230	4	1207	21	2172	38
0287	5	1265	22	2228	39
0345	6	1323	23	2284	40
0403	7	1381	24	2343	41
0460	8	1439	25	2402	42
0518	9	1496	26	2462	43
0575	10	1554	27	2522	44
0632	11	1612	28	2583	45
0690	12	1670	29	2644	46
0747	13	1724	30	2705	47
0805	14	1780	31	2766	48
0862	15	1836	32	2828	49
0920	16	1892	33	2890	50
0977	17	1948	34		

144. Specific Gravity, etc., of Ammonium Sulphate Solutions at 15° C. (Gerlach.)

Specific Gravity.	Percentage of $(NH_4)_2SO_4$.	Specific Gravity.	Percentage of $(NH_4)_2SO_4$.
1·0181	3	1·1190	20
0359	6	1773	30
0600	10	2352	40

145. Kohlrausch gives the following for $(NH_4)_2SO_4$ Solutions at 15° C.

Specific Gravity.	Percentage of $(NH_4)_2SO_4$.	Specific Gravity.	Percentage of $(NH_4)_2SO_4$.
5	1·0292	30	1·1730
10	0581	31	1787
20	1160		

TABLE LXXIIc.—*continued.*

146. Specific Gravity, etc., of Lithium Sulphate Solutions at 19°·5 C. (Kremers.)

Specific Gravity.	Percentage of Li_2SO_4.
1·05	6·5
06	7·4
098	12·5
118	15·3
167	22·6
178	24·4
208	29·4

Kohlrausch gives for Li_2SO_4 Solutions at 15° C. :—
5 % Li_2SO_4≡Sp. Gr. 1·0430 ; 10 % Li_2SO_4≡Sp. Gr. 1·0877.

147. Specific Gravity, etc., of Sodium Sulphate Solutions at 19° C.

Specific Gravity.	Percentage of $Na_2SO_4+10H_2O$.	Percentage of Na_2SO_4.	Specific Gravity.	Percentage of $Na_2SO_4+10H_2O$.	Percentage of Na_2SO_4.
1·0040	1	·441	1·0642	16	7·056
0079	2	·881	0683	17	7·497
0118	3	1·323	0725	18	7·938
0158	4	1·764	0766	19	8·379
0198	5	2·205	0807	20	8·820
0238	6	2·646	0849	21	9·261
0278	7	3·087	0890	22	9·702
0318	8	3·528	0931	23	10·143
0358	9	3·969	0973	24	10·584
0398	10	4·410	1015	25	11·025
0439	11	4·851	1057	26	11·466
0479	12	5·292	1100	27	11·907
0520	13	5·733	1142	28	12·348
0560	14	6·174	1184	29	12·789
0601	15	6·615	1226	30	13·230

TABLE LXXIIc.—*continued.*

148. Specific Gravity, etc., of Sodium Sulphate Solutions at 15° C. (Gerlach.)

Specific Gravity.	Percentage of		Specific Gravity.	Percentage of	
	Crystallised $Na_2SO_4.10H_2O$.	Anhydrous.		Crystallised $Na_2SO_4.10H_2O$.	Anhydrous.
1·004	1	0·441	1·064	16	7·056
008	2	0·881	069	17	7·497
013	3	1·323	073	18	7·938
016	4	1·764	077	19	8·379
020	5	2·205	082	20	8·820
024	6	2·646	086	21	9·261
028	7	3·087	090	22	9·702
032	8	3·528	094	23	10·143
036	9	3·969	098	24	10·584
040	10	4·410	103	25	11·025
044	11	4·851	107	26	11·466
047	12	5·292	111	27	11·907
052	13	5·733	116	28	12·348
056	14	6·174	120	29	12·789
060	15	6·615	125	30	13·230

149. Specific Gravity, etc., of Sodium Sulphate Solutions at 15° C. (Gerlach.)

Specific Gravity.	Percentage of Na_2SO_4.	Specific Gravity.	Percentage of Na_2SO_4.	Specific Gravity.	Percentage of Na_2SO_4.
1·00911	1	1·04576	5	1·08325	9
01822	2	05500	6	09275	10
02736	3	06437	7	10246	11
03650	4	07375	8	11170	11·952. Sat.

Kohlrausch gives the following for Na_2SO_4 Solutions at 18° C. :—
5 % Na_2SO_4≡Sp. Gr. 1·0450 ; 10 % Na_2SO_4≡Sp. Gr. 1·0915 ; 15 % Na_2SO_4≡Sp. Gr. 1·426.

150. Specific Gravity, etc., of Potassium Sulphate Solutions at 15° C. (Gerlach.)

Specific Gravity.	Percentage of K_2SO_4.	Specific Gravity.	Percentage of K_2SO_4.
1·00820	1	1·04947	6
01635	2	05790	7
02450	3	06644	8
03277	4	07499	9
04105	5	08305	9·92. Sat.

Kohlrausch gives the following for K_2SO_4 Solutions at 18° C. :—
5 % K_2SO_4≡Sp. Gr. 1·0395 ; 10 % K_2SO_4≡1·0815.

TABLE LXXIIc.—*continued.*

151. Specific Gravity, etc., of Potassium-Hydrogen Sulphate Solutions at 18° C. (Kohlrausch.)

Specific Gravity.	Percentage of $KHSO_4$.	Specific Gravity.	Percentage of $KHSO_4$.	Specific Gravity.	Percentage of $KHSO_4$.
1·0354	5	1·1116	15	1·1920	25
1·0726	10	1·1516	20	1·2110	27

152. Specific Gravity, etc., of Solutions of Magnesium Sulphate at 15° C. (Gerlach.)

Specific Gravity.	Percentage of $MgSO_4$.	Percentage of $MgSO_4+7H_2O$.	Specific Gravity.	Percentage of $MgSO_4$.	Percentage of $MgSO_4+7H_2$.
1·01031	1	2·049	1·15083	14	28·682
02062	2	4·097	16222	15	30·731
03092	3	6·146	17420	16	32·780
04123	4	8·195	18618	17	34·528
05154	5	10·243	19816	18	36·877
06229	6	12·292	21014	19	38·926
07304	7	14·341	22212	20	40·975
08379	8	16·390	23465	21	43·023
09454	9	18·438	24718	22	45·072
10529	10	20·487	25972	23	47·121
11668	11	22·536	27225	24	49·170
12806	12	24·585	28478	25	51·319
13945	13	26·633	28802	25·25	51·726

153. Specific Gravity, etc., of Solutions of Crystallised Magnesium Sulphate at 15° C. (Gerlach.)

Specific Gravity.	Percentage of Salt.	Specific Gravity.	Percentage of Salt.	Specific Gravity.	Percentage of Salt.	Specific Gravity.	Percentage of Salt.
1·005	1	1·076	15	1·146	28	1·222	41
010	2	082	16	151	29	229	42
016	3	087	17	156	30	235	43
021	4	092	18	163	31	240	44
026	5	097	19	170	32	246	45
031	6	102	20	175	33	253	46
036	7	108	21	181	34	260	47
040	8	114	22	187	35	266	48
045	9	120	23	193	36	272	49
051	10	125	24	199	37	279	50
056	11	130	25	204	38	285	51
061	12	135	26	210	39	291	52
066	13	140	27	216	40	299	53
071	14						

TABLE LXXIIc.—*continued.*

154. Specific Gravity, etc., of Magnesium Sulphate Solutions at 12° C. (Oudemans.)

Specific Gravity.	Percentage of $MgSO_4+7H_2O$.	Percentage of $MgSO_4$.	Specific Gravity.	Percentage of $MgSO_4+7H_2O$.	Percentage of $MgSO_4$.
1·0046	1	0·4884	1·1071	21	10·2570
0096	2	0·9769	1125	22	10·7455
0146	3	1·4653	1179	23	11·2339
0196	4	1·9537	1234	24	11·7223
0246	5	2·4422	1289	25	12·2107
0296	6	2·9306	1344	26	12·6992
0346	7	3·4190	1399	27	13·1876
0396	8	3·9074	1454	28	13·6760
0446	9	4·3959	1510	29	14·1645
0497	10	4·8843	1566	30	14·6529
0548	11	5·3727	1622	31	15·1413
0599	12	5·8612	1679	32	15·6298
0650	13	6·3496	1736	33	16·1182
0702	14	6·8380	1793	34	16·6066
0754	15	7·3265	1850	35	17·0950
0807	16	7·8149	1908	36	17·5835
0859	17	8·3033	1965	37	18·0719
0911	18	8·7917	2023	38	18·5603
0964	19	9·2802	2082	39	19·0488
1018	20	9·7686	2140	40	19·5372

Kohlrausch gives for $MgSO_4$ Solutions at 15° C. :—
5% $MgSO_4$≡Sp. Gr. 1·0510 ; 10 % $MgSO_4$≡Sp. Gr. 1·1052 ; 15 % $MgSO_4$≡1·1602 ; 20 % $MgSO_4$≡1·2200 ; 25 % $MgSO_4$≡1·2861.

155. Specific Gravity, etc., of Aluminium Sulphate Solutions at 15° C. (Gerlach and Reuss.)

Specific Gravity.	Percentage of $Al_2(SO_4)_3$.	Percentage of $Al_2(SO_4)_3 + 18H_2O$.
0569	5	9·737
1075	10	19·474
1105	10·282	20
1574	15	29·211
1710	15·423	30
2074	20	38·948
2355	20·564	40
2572	25	48·685
3050	25·705	50

156. Specific Gravity, etc., of Aluminium Sulphate Solutions at various Temperatures. (Reuss.)

Pct. of $Al_2(SO_4)_3$.	Specific Gravity at 15° C.	25° C.	35° C.	45° C.
5	1·0569	1·0503	1·045	1·0356
10	1071	1022	096	085
15	1574	1522	146	1346
20	2074	2004	192	1801
25	2572	2483	2407	2295

TABLE LXXIIc.—*continued.*

157. Specific Gravity, etc., of Aluminium Sulphate Solutions at 15° C. (E. Larsson.)
(Alum-maker's Table.)

Specific Gravity.	Degrees Baumé.	100 kilogrammes of the Solution contain					100 litres of the Solution contain				
		Al_2O_3.	SO_3.	Sulphate with 13 per cent. Al_2O_3.	Sulphate with 14 per cent. Al_2O_3.	Sulphate with 15 per cent. Al_2O_3.	Al_2O_3.	SO_3.	Sulphate with 13 per cent. Al_2O_3.	Sulphate with 14 per cent. Al_2O_3.	Sulphate with 15 per cent. Al_2O_3.
		kgms.	kgms.	kgms.	kgms.	kgms.	kgms.	kgms.	kgms.	kgms.	kgms.
1·005	0·7	0·14	0·32	1·1	1·0	0·9	0·14	0·33	1·1	1	0·9
010	1·4	0·27	0·64	2·1	2·0	1·8	0·28	0·65	2·2	2	1·9
016	2·1	0·41	0·95	3·1	2·9	2·7	0·42	0·98	3·2	3	2·8
021	2·8	0·55	1·27	4·2	3·9	3·6	0·56	1·31	4·3	4	3·7
026	3·5	0·68	1·59	5·3	4·9	4·6	0·70	1·63	5·4	5	4·7
031	4·2	0·81	1·89	6·3	5·8	5·4	0·84	1·96	6·5	6	5·6
036	4·8	0·94	2·20	7·3	6·7	6·3	0·98	2·28	7·5	7	6·5
040	5·4	1·07	2·50	8·3	7·7	7·2	1·12	2·61	8·6	8	7·5
045	6·1	1·20	2·80	9·3	8·6	8·0	1·26	2·94	9·7	9	8·4
050	6·7	1·33	3·11	10·3	9·5	8·9	1·40	3·26	10·8	10	9·3
055	7·3	1·46	3·40	11·2	10·4	9·7	1·54	3·59	11·8	11	10·3
059	7·9	1·58	3·69	12·2	11·3	10·6	1·68	3·91	12·9	12	11·2
064	8·5	1·71	3·98	13·1	12·2	11·4	1·82	4·24	14·0	13	12·1
068	9·1	1·83	4·27	14·1	13·1	12·2	1·96	4·57	15·1	14	13·1
073	9·7	1·96	4·56	15·1	14·0	13·1	2·10	4·89	16·2	15	14·0
078	10·3	2·08	4·84	16·0	14·8	13·9	2·24	5·22	17·2	16	14·9
082	10·9	2·20	5·12	16·9	15·7	14·6	2·38	5·55	18·3	17	15·9
087	11·4	2·32	5·40	17·8	16·5	15·4	2·52	5·87	19·4	18	16·8
092	12·0	2·44	5·67	18·7	17·4	16·2	2·66	6·20	20·5	19	17·7
096	12·6	2·55	5·95	19·6	18·3	17·0	2·80	6·52	21·5	20	18·7
101	13·1	2·67	6·22	20·5	19·1	17·8	2·94	6·85	22·6	21	19·6
105	13·7	2·78	6·49	21·4	19·9	18·6	3·08	7·18	23·7	22	20·5
110	14·2	2·90	6·76	22·3	20·7	19·3	3 22	7·50	24·8	23	21·5
114	14·7	3·01	7·02	23·2	21·5	20·1	3·36	7·83	25·9	24	22·4
119	15·3	3·13	7·29	24·1	22·4	20·9	3·50	8·16	26·9	25	23·3
123	15·8	3·24	7·55	24·9	23·1	21·6	3·64	8·48	28·0	26	24·3
128	16·3	3·35	7·81	25·8	23·9	22·3	3·78	8·81	29·1	27	25·2
132	16·8	3·46	8·06	26·6	24·7	23·1	3·92	9·13	30·2	28	26·1
137	17·4	3·57	8·32	27·5	25·5	23·8	4·06	9·46	31·2	29	27·1
141	17·9	3·68	8·58	28·3	26·3	24·5	4·20	9·79	32·3	30	28·0
145	18·3	3·79	8·83	29·1	27·1	25·3	4·34	10·11	33·4	31	28·9
150	18·8	3·89	9·07	30·0	27·8	26·0	4·48	10·44	34·5	32	29·9
154	19·2	4·00	9·32	30·8	28·6	26·7	4·64	10·76	35·5	33	30·8
159	19·7	4·11	9·57	31·6	29·3	27·4	4·76	11·09	36·6	34	31·7
163	20·1	4·21	9·82	32·4	30·1	28·1	4·90	11·42	37·7	35	32·7
168	20·6	4·32	10·06	33·2	30·8	28·9	5·04	11·74	38·8	36	33·6
172	21·1	4·42	10·29	34·0	31·6	29·5	5·18	12·07	39·9	37	34·5
176	21·6	4·52	10·53	34·8	32·3	30·1	5·32	12·40	40·9	38	35·5

TABLE LXXIIc.—*continued.*

157. Specific Gravity, etc., of Aluminium Sulphate Solutions at 15° C.—*continued.*

Specific Gravity.	Degrees Baumé.	100 kilogrammes of the Solution contain					100 litres of the Solution contain				
		Al_2O_3.	SO_3.	Sulphate with 13 per cent. Al_2O_3.	Sulphate with 14 per cent. Al_2O_3.	Sulphate with 15 per cent. Al_2O_3.	Al_2O_3.	SO_3.	Sulphate with 13 per cent. Al_2O_3.	Sulphate with 14 per cent. Al_2O_3.	Sulphate with 15 per cent. Al_2O_3.
		kgms.	kgms.	kgms.	kgms.	kgms.	kgms.	kgms.	kgms.	kgms.	kgms.
1·181	22·1	4·62	10·77	35·6	33·0	30·8	5·46	12·72	42·0	39	36·4
185	22·5	4·72	11·01	36·3	33·7	31·5	5·60	13·05	43·1	40	37·3
190	23·0	4·82	11·24	37·1	34·5	32·2	5·74	13·38	44·2	41	38·3
194	23·4	4·92	11·47	37·9	35·2	32·8	5·88	13·70	45·2	42	39·2
198	23·8	5·02	11·70	38·6	35·9	33·5	6·02	14·03	46·3	43	40·1
203	24·3	5·12	11·93	39·4	36·6	34·1	6·16	14·35	47·4	44	41·1
207	24·7	5·22	12·16	40·2	37·3	34·8	6·30	14·68	48·5	45	42·0
211	25·2	5·32	12·39	40·9	38·0	35·4	6·44	15·01	49·5	46	42·9
215	25·5	5·41	12·61	41·6	38·7	36·1	6·58	15·33	50·6	47	43·9
220	25·9	5·51	12·83	42·4	39·3	36·7	6·72	15·66	51·7	48	44·8
224	26·3	5·60	13·06	43·1	40·0	37·4	6·86	15·99	52·8	49	45·7
228	26·7	5·70	13·28	43·9	40·7	38·0	7·00	16·31	53·9	50	46·7
232	27·1	5·79	13·50	44·6	41·4	38·6	7·14	16·64	54·9	51	47·6
236	27·5	5·89	13·72	45·3	42·1	39·3	7·28	16·96	56·0	52	48·5
240	27·9	5·98	13·94	46·0	42·7	39·9	7·42	17·29	57·1	53	49·5
244	28·3	6·08	14·16	46·7	43·4	40·5	7·56	17·62	58·2	54	50·4
248	28·6	6·17	14·38	47·5	44·1	41·1	7·70	17·94	59·2	55	51·3
252	29·0	6·26	14·59	48·2	44·7	41·7	7·84	18·27	60·3	56	52·3
256	29·4	6·35	14·80	48·9	45·4	42·3	7·98	18·59	61·4	57	53·2
261	29·8	6·44	15·01	49·5	46·0	42·9	8·12	18·92	62·5	58	54·1
265	30·2	6·53	15·22	50·2	46·7	43·5	8·26	19·25	63·5	59	55·1
269	30·5	6·62	15·43	50·9	47·3	44·1	8·40	19·57	64·6	60	56·0
273	30·9	6·71	15·63	51·6	47·9	44·7	8·54	19·90	65·7	61	56·9
277	31·2	6·80	15·84	52·3	48·6	45·3	8·68	20·23	66·8	62	57·9
281	31·6	6·89	16·04	53·0	49·2	45·9	8·82	20·55	67·9	63	58·8
285	31·9	6·97	16·25	53·7	49·8	46·5	8·96	20·88	68·9	64	59·7
289	32·3	7·06	16·46	54·3	50·5	47·1	9·10	21·20	70·0	65	60·7
293	32·6	7·15	16·66	55·0	51·1	47·7	9·24	21·53	71·1	66	61·6
297	33·0	7·23	16·85	55·6	51·7	48·2	9·38	21·86	72·2	67	62·5
301	33·3	7·32	17·05	56·3	52·3	48·8	9·52	22·18	73·2	68	63·5
305	33·7	7·40	17·25	57·0	52·9	49·4	9·66	22·51	74·3	69	64·4
309	34·0	7·49	17·45	57·6	53·5	49·9	9·80	22·84	75·4	70	65·3
312	34·4	7·57	17·65	58·3	54·1	50·5	9·94	23·16	76·5	71	66·3
316	34·7	7·66	17·84	58·9	54·5	51·1	10·08	23·49	77·5	72	67·2
320	35·0	7·74	18·04	59·6	55·3	51·6	10·22	23·81	78·6	73	68·1
324	35·3	7·83	18·23	60·2	55·9	52·2	10·36	24·14	79·7	74	69·1
328	35·6	7·91	18·43	60·8	56·5	52·7	10·50	24·47	80·8	75	70·0
331	35·9	7·99	18·62	61·5	57·1	53·3	10·64	24·79	81·8	76	70·9
335	36·2	8·07	18·81	62·1	57·7	53·8	10·78	25·12	82·9	77	71·9
339	36·5	8·16	19·00	62·7	58·3	54·4	10·92	25·45	84·0	78	72·8

TABLE LXXIIc.—*continued.*

158. Specific Gravity, etc., of Chromic Sulphate Solutions at 15° C. (Gerlach.)

Specific Gravity for		Percentage of		Specific Gravity for		Percentage of	
Violet Variety.	Green Variety.	$Cr_2(SO_4)_3$.	$Cr_2(SO_4)_3 + 18H_2O$.	Violet Variety.	Green Variety.	$Cr_2(SO_4)_3$.	$Cr_2(SO_4)_3 + 18H_2O$.
1·0275		2·740	5	1·1875	1·1680	16·443	30
038	1·034	3·779	6·897	211	201	19·072	34·804
0560	0510	5·481	10	2480	2340	21·924	40
075	068	7·283	13·291	3250	3055	27·404	50
110	102	10·542	19·238	337	316	28·202	51·464
1150	1070	10·962	20		3825	32·887	60
145	136	13·579	24·779		445	37·075	67·657
178	168	16·416	29·957		4650	38·368	70
					5535	43·848	80
					556	43·996	80·287

159. Specific Gravity, etc., of Manganese Sulphate ($MnSO_4 + 4H_2O$) Solutions at 15° C. (Gerlach.)

Specific Gravity.	Pct. of Salt.	Specific Gravity.	Pct. of Salt.	Specific Gravity.	Pct. of Salt.	Specific Gravity.	Pct. of Salt.	Specific Gravity.	Pct. of Salt.
1·006	1	1·079	12	1·160	23	1·250	34	1·3495	45
013	2	085	13	166	24	2579	35	360	46
020	3	093	14	1751	25	268	36	370	47
025	4	1001	15	183	26	276	37	380	48
0320	5	106	16	190	27	285	38	389	49
038	6	114	17	200	28	295	39	3986	50
044	7	121	18	208	29	3038	40	410	51
050	8	129	19	2150	30	313	41	420	52
056	9	1363	20	224	31	322	42	430	53
0650	10	144	21	231	32	331	43	440	54
072	11	150	22	244	33	340	44	4514	55

TABLE LXXIIc.—*continued.*

160. Specific Gravity, etc., of Manganese Sulphate Solutions at 15° C. (Gerlach.)

Percentage of Salt.	Specific Gravity for			
	$MnSO_4$.	$MnSO_4+4H_2O$.	$MnSO_4+5H_2O$.	$MnSO_4+7H_2O$.
5	1·0500	1·0340	1·0310	1·0270
10	1035	0690	0630	0545
15	1605	1055	0965	0830
20	2215	1435	1315	1130
25	2870	1835	1685	1440
30	3575	2255	2070	1765
35		2695	2470	2105
40		3155	2885	2455
45		3640	3315	2815
50			3760	3185
55				3565

161. Specific Gravity, etc., of Manganese Sulphate Solutions at 0° C. (Charpy.)

Specific Gravity.	Percentage of $MnSO_4$.	Specific Gravity.	Percentage of $MnSO_4$.	Specific Gravity.	Percentage of $MnSO_4$.
1·0315	3·0865	1·0928	8·8295	1·1519	14·0462
0622	6·0172	1239	11·5804	1834	16 7450

162. Specific Gravity, etc., of Ferrous Sulphate Solutions at 15° C. (Gerlach.)

Specific Gravity.	Percentage of		Specific Gravity.	Percentage of		Specific Gravity.	Percentage of	
	$FeSO_4+7H_2O$.	$FeSO_4$.		$FeSO_4+7H_2O$.	$FeSO_4$.		$FeSO_4+7H_2O$	$FeSO_4$.
1·005	1	0·5468	1·082	15	8·2015	1·168	29	15·8562
011	2	1·0935	088	16	8·7483	174	30	16·4030
016	3	1·6403	094	17	9·2950	180	31	16·9498
021	4	2 1871	100	18	9·8418	187	32	17·4965
027	5	2·7338	106	19	10·3886	193	33	18·0433
032	6	3·2806	112	20	10·9353	200	34	18·5900
037	7	3·8274	118	21	11·4821	206	35	19·1368
043	8	4·3741	125	22	12·0289	213	36	19·6836
048	9	4·9209	131	23	12·5756	219	37	20·2303
054	10	5·4677	137	24	13·1224	226	38	20·7771
059	11	6·0144	143	25	13·6692	232	39	21·3239
065	12	6·5612	149	26	14·2159	239	40	21·8706
071	13	7·1080	155	27	14·7627			
077	14	7·6547	161	28	15·3095			

TABLE LXXIIc.—*continued.*

163. Specific Gravity, etc., of Ferric Sulphate Solutions at 18° C. (Hager.)

Specific Gravity.	Pct. of $Fe_2(SO_4)_3$.	Specific Gravity.	Pct. of $Fe_2(SO_4)_3$.	Specific Gravity.	Pct. of $Fe_2(SO_4)_3$	Specific Gravity.	Pct. of $Fe_2(SO_4)_3$.	Specific Gravity.	Pct. of $Fe_2(SO_4)_3$.
1·008	1	1·097	10	1·196	19	1·310	28	1·442	37
017	2	107	11	208	20	323	29	458	38
027	3	118	12	220	21	337	30	474	39
036	4	129	13	232	22	351	31	490	40
046	5	140	14	245	23	365	32	506	41
057	6	151	15	258	24	380	33	523	42
067	7	162	16	271	25	395	34	540	43
077	8	173	17	284	26	411	35	557	44
087	9	184	18	297	27	427	36		

164. Specific Gravity, etc., of Ferric Sulphate Solutions at 17°·5 C. (Franz.)

Specific Gravity.	Percent $Fe_2(SO_4)_3$.	Specific Gravity.	Percent. $Fe_2(SO_4)_3$.	Specific Gravity.	Percent $Fe_2(SO_4)_3$.	Specific Gravity.	Percent. $Fe_2(SO_4)_3$.
1·0426	5	1·1826	20	1·3782	35	1·6148	50
0854	10	2426	25	4506	40	7050	55
1324	15	3090	30	5298	45	8006	60

165. Specific Gravity, etc., of Solutions of the Sulphates of Cobalt and Nickel at 0° C. (Charpy.)

Specific Gravity.	Percentage of $NiSO_4$.	Specific Gravity.	Percentage of $CoSO_4$.
1·0089	0·8327	1·0131	1·2099
0173	1·6131	0263	2·4273
0271	2·5043	0392	3·5792
0357	3·2845	0517	4·7095
0431	3·9591	0641	5·8140
0522	4·2930	0765	6·8910

TABLE LXXIIc.—*continued.*

166. Specific Gravity, etc., of Copper Sulphate Solutions at 18° C. (Schiff and Gerlach.)

Specific Gravity.	Percentage of		Specific Gravity.	Percentage of		Specific Gravity.	Percentage of	
	$CuSO_4 + 5H_2O$.	$CuSO_4$.		$CuSO_4 + 5H_2O$.	$CuSO_4$.		$CuSO_4 + 5H_2O$.	$CuSO_4$.
1·0063	1	0·6393	1·0716	11	7·0321	1·1427	21	13·4249
0126	2	1·2786	0785	12	7·6714	1501	22	14·0642
0190	3	1·9178	0854	13	8·3106	1585	23	14·7034
0254	4	2·5571	0923	14	8·9499	1659	24	15·3427
0319	5	3·1964	0993	15	9·5892	1738	25	15·9820
0384	6	3·8357	1063	16	10·2285	1817	26	16·6213
0450	7	4·4750	1135	17	10·8678	1898	27	17·2605
0516	8	5·1142	1208	18	11·5070	1980	28	17·8998
0582	9	5·7535	1281	19	12·1463	2063	29	18·5391
0649	10	6·3928	1354	20	12·7856	2146	30	19·1784

Charpy gives the following for $CuSO_4$ Solutions at 0° C. :—

Sp. Gr. 1·0290, % $CuSO_4$ 2·6460; Sp. Gr. 1·0578, % $CuSO_4$ 5·2181; Sp. Gr. 1·0833, % $CuSO_4$ 7·5474; Sp. Gr. 1·1108, % $CuSO_4$ 9·8159; Sp. Gr. 1·1371, % $CuSO_4$ 11·9315.

And Kohlrausch for Solutions at 18° C. :—

5 % $CuSO_4$≡Sp. Gr. 1·0513; 10 % $CuSO_4$≡Sp. Gr. 1·1073; 15 % $CuSO_4$≡Sp. Gr. 1·1675; 17·5 % $CuSO_4$≡Sp. Gr. 1·2003.

167. Specific Gravity, etc., of Zinc Sulphate ($ZnSO_4 + 7H_2O$) Solutions at 15° C. (Gerlach.)

Specific Gravity.	Percentage of Salt.		Specific Gravity.	Percentage of Salt.		Specific Gravity.	Percentage of Salt.	
	Cryst.	Anhydrous.		Cryst.	Anhydrous.		Cryst.	Anhydrous.
1·006	1	0·5421	1·130	21	11·3849	1·280	41	22·2276
013	2	1·0843	137	22	11·9270	288	42	22·7697
019	3	1·6264	143	23	12·4691	295	43	23·3119
024	4	2·1685	150	24	13·0113	304	44	23·8540
0288	5	2·7107	1574	25	13·5534	3100	45	24·3961
035	6	3·2528	164	26	14·0955	320	46	24·9383
041	7	3·7950	171	27	14·6377	330	47	25·4804
047	8	4·3371	179	28	15·1798	337	48	26·0225
053	9	4·8792	185	29	15·7219	346	49	26·5647
0593	10	5·4214	1933	30	16·2641	3532	50	27·1068
066	11	5·9635	200	31	16·8062	362	51	27·6489
073	12	6·5056	209	32	17·3484	370	52	28·1911
079	13	7·0478	216	33	17·8905	380	53	28·7332
085	14	7·5899	224	34	18·4326	390	54	29·2753
0905	15	8·1320	231	35	18·9748	3986	55	29·8175
097	16	8·6742	240	36	19·5169	406	56	30·3596
103	17	9·2163	246	37	20·0590	416	57	30·9018
110	18	9·7585	255	38	20·6012	425	58	31·4439
116	19	10·3006	263	39	21·1433	435	59	31·9860
1236	20	10·8427	2709	40	21·6854	4451	60	32·5282

TABLE LXXIIc.—*continued.*

168. Specific Gravity, etc., of Zinc Sulphate Solutions at 20°·5 C. (Schiff.)

Specific Gravity.	% $ZnSO_4 + 7H_2O$.	Specific Gravity.	% $ZnSO_4 + 7H_2O$.	Specific Gravity.	% $ZnSO_4 + 7H_2O$.	Specific Gravity.	% $ZnSO_4 + 7H_2O$.
1·0057	1	1·0962	16	1·1987	31	1·3167	46
0115	2	1026	17	2060	32	3252	47
0173	3	1091	18	2134	33	3338	48
0231	4	1156	19	2209	34	3424	49
0289	5	1222	20	2285	35	3511	50
0348	6	1288	21	2362	36	3599	51
0407	7	1355	22	2439	37	3688	52
0467	8	1423	23	2517	38	3779	53
0527	9	1491	24	2595	39	3871	54
0588	10	1560	25	2674	40	3964	55
0649	11	1629	26	2754	41	4057	56
0710	12	1699	27	2834	42	4151	57
0772	13	1770	28	2917	43	4246	58
0835	14	1842	29	3000	44	4342	59
0899	15	1914	30	3083	45	4439	60

169. Specific Gravity, etc., of Zinc Sulphate Solutions at 18° C. (Kohlrausch.)

Specific Gravity.	Percentage of	
	$ZnSO_4$.	$ZnSO_4 + 7H_2O$.
1·0509	5	8·913
1069	10	17·826
1675	15	26·739
2323	20	35·652
3045	25	44·565
3788	30	53·478

170. Specific Gravity, etc., of Zinc Sulphate Solutions at 0° C. (Charpy.)

Specific Gravity.	Percentage of $ZnSO_4$.
1·0565	5·1110
1106	9·7426
1645	14·0307
2145	17·7573
2665	21·4444
3152	24·7170

171. Density, etc., of Cerium Sulphate Solutions at 15° C. (Bromner.)

Density.	Percentage of $Cl_2(SO_4)_3$.	Density.	Percentage of $Cl_2(SO_4)_3$.
1·0301	3·07	1·1192	11·23
0581	5·76	1367	12·70
0800	7·80	1462	13·53
0909	8·77	1964	17·48
0994	9·54	2878	24·02

TABLE LXXIIc.—*continued.*

172. Specific Gravity, etc., of Ammonio-Sodic Sulphate Solutions at 15° C. (Schiff.)

Specific Gravity.	Percentage of $NH_4NaSO_4+2H_2O$.	Specific Gravity.	Percentage of $NH_4NaSO_4+2H_2O$.	Specific Gravity.	Percentage of $NH_4NaSO_4+2H_2O$.
1·0337	6·36	1·0849	15·9	1·1749	31·8
0679	12·72	1380	25·44		

173. Specific Gravity, etc., of Ammonio-Ferrous Sulphate $\{(NH_4)_2Fe(SO_4)_2+H_2O\}$ at 19° C. (Schiff.)

Specific Gravity.	Percentage of Salt.	Specific Gravity.	Percentage of Salt.	Specific Gravity.	Percentage of Salt.	Specific Gravity.	Percentage of Salt.
1·006	1	1·054	9	1·104	17	1·156	25
013	2	060	10	110	18	164	26
018	3	066	11	116	19	171	27
024	4	073	12	124	20	179	28
030	5	080	13	130	21	185	29
036	6	085	14	136	22	193	30
042	7	092	15	143	23		
047	8	097	16	150	24		

174. Specific Gravity of Potassium Magnesium Sulphate $(K_2Mg(SO_4)_2+6H_2O)$ Solutions at 15° C. (Schiff.)

Specific Gravity.	Percentage of Salt.	Specific Gravity.	Percentage of Salt.	Specific Gravity.	Percentage of Salt.	Specific Gravity.	Percentage of Salt.
1·0064	1	1·0462	7	1·0878	13	1·1314	19
0129	2	0530	8	0950	14	1388	20
0195	3	0599	9	1021	15	1463	21
0261	4	0668	10	1094	16	1539	22
0327	5	0737	11	1167	17		
0394	6	0808	12	1240	18		

TABLE LXXIIc.—*continued.*

175. Specific Gravity, etc., of Potassium Alum and Ammonium Alum at 17°·5 C.

Percentage of Alum.	Specific Gravity of Solution of $K_2Al_2(SO_4)_4 + 24H_2O$.	Specific Gravity of Solution of $(NH_4)_2Al_2(SO_4)_4 + 24H_2O$.
1	1·0065	1·0060
2	0110	0109
3	0166	0156
4	0218	0200
5	0269	0255
6	0320	0305

176. Specific Gravity, etc., of Potassium Alum Solutions at 17°·5 C. according to Gerlach.

1	1·0049
2	0100
3	0152
4	0205
5	0258
6	0310
7	0362
8	0415
9	0469
10	0523
11	0578
12	0635
13	0690

177. Specific Gravity, etc., of Ammonium Alum Solutions at 15° C. according to Gerlach.

3%	1·0141
6	0282
9	0423

178. Specific Gravity, etc., of Potassium Chrome Alum Solutions at 17°·5 C. (Franz.)

Specific Gravity.	Percentage of $K_2Cr_2(SO_4)_4 + 24H_2O$.	Specific Gravity.	Percentage of $K_2Cr_2(SO_4)_4 + 24H_2O$.	Specific Gravity.	Percentage of $K_2Cr_2(SO_4)_4 + 24H_2O$.	Specific Gravity.	Percentage of $K_2Cr_2(SO_4)_4 + 24H_2O$.
1·0035	1	1·0700	19	1·1702	37	1·3542	54
0070	2	0746	20	1767	38	3704	55
0105	3	0798	21	1832	39	3876	56
0140	4	0850	22	1896	40	4048	57
0174	5	0902	23	1987	41	4220	58
0209	6	0954	24	2078	42	4392	59
0244	7	1004	25	2169	43	4566	60
0279	8	1060	26	2260	44	4743	61
0314	9	1116	27	2352	45	4920	62
0342	10	1172	28	2460	46	5097	63
0378	11	1228	29	2568	47	5274	64
0414	12	1274	30	2676	48	5452	65
0450	13	1334	31	2784	49	·5634	66
0486	14	1394	32	2894	50	5816	67
0524	15	1454	33	3056	51	5998	68
0568	16	1514	34	3218	52	6180	69
0612	17	1572	35	3380	53	6362	70
0656	18	1637	36				

TABLE LXXIIc.—*continued.*

179. Specific Gravity, etc., of Solutions of various Alums at 15° C. (Gerlach.)
V.≡Violet Variety: G.≡Green Variety.

Percentage of Crystallised Alum.	Specific Gravity for				Corresponding Percentage of Anhydrous Alum for			
	Am-Fe Alum.	Am-Cr Alum (Green).	K-Fe Alum.	K-Cr. Alum.	Am-Fe Alum.	Am-Cr Alum.	K-Fe Alum.	K-Cr Alum.
5	1·023		1·0250	V. 1·0272	2·76		2·854	2·839
10	047	1·044	0507	Gr. 0510 V. 0550	5·52	5·486	5·708	5·677
15	071		0773	V. 0835	8·28		8·561	8·516
20	096	091	1050	Gr. 103	11·04	10·972	11·415	11·355
25	122		1340		13·80		14·269	
30	148	142	1645	,, 161	16·56	16·458	17·123	17·032
35	175		1967		19·32		19·976	
40	203	197		,, 225	22·08	21·944		22·710
50		255		,, 295		27·429		28·387
60		317		,, 371		32·915		34·065
70		384		,, 453		38·401		39·742
80		456		,, 541		43·887		45·420
90		532		,, 635		49·373		51·097

180.—Specific Gravity, etc., of Potassio-Ferric Alum Solutions at 17°·5 C. (Franz.)

Specific Gravity.	Percentage of $K_2Fe_2(SO_4)_4 + 24H_2O$.	Specific Gravity.	Percentage of $K_2Fe_2(SO_4)_4 + 24H_2O$.	Specific Gravity.	Percentage of $K_2Fe_2(SO_4)_4 + 24H_2O$.	Specific Gravity.	Percentage of $K_2Fe_2(SO_4)_4 + 24H_2O$.
1·0054	1	1·0428	9	1·0760	17	1·1136	25
0108	2	0466	10	0804	18	1193	26
0162	3	0507	11	0848	19	1250	27
0216	4	0548	12	0894	20	1307	28
0268	5	0589	13	0942	21	1364	29
0308	6	0630	14	0990	22	1422	30
0348	7	0672	15	1038	23		
0388	8	0716	16	1086	24		

TABLE LXXIIc.—*continued.*

181. Specific Gravity, etc., of Sodium Thiosulphate Solutions at 19° C. (Schiff.)

Specific Gravity.	Percentage of $Na_2S_2O_3+5H_2O$.	Percentage of $Na_2S_2O_3$.	Specific Gravity.	Percentage of $Na_2S_2O_3+5H_2O$.	Percentage of $Na_2S_2O_3$.
1·0052	1	0·637	1·1440	26	16·564
0105	2	1·274	1499	27	17·201
0158	3	1·911	1558	28	17·838
0211	4	2·584	1617	29	18·475
0264	5	3·185	1676	30	19·113
0317	6	3·822	1738	31	19·750
0370	7	4·459	1800	32	20·387
0423	8	5·096	1862	33	21·024
0476	9	5·733	1924	34	21·661
0529	10	6·371	1986	35	22·298
0584	11	7·008	2048	36	22·935
0639	12	7·645	2110	37	23·572
0695	13	8·282	2172	38	24·209
0751	14	8·919	2234	39	24·846
0807	15	9·556	2297	40	25·484
0863	16	10·193	2362	41	26·121
0919	17	10·830	2427	42	26·758
0975	18	11·467	2492	43	27·395
1031	19	12·105	2558	44	28·032
1087	20	12·742	2624	45	28·669
1145	21	13·379	2690	46	29·306
1204	22	14·016	2756	47	29·943
1263	23	14·653	2822	48	30·580
1322	24	15·290	2888	49	31·218
1381	25	15·927	2954	50	31·855

182. Specific Gravity, etc., of Potassium Chromate Solutions at 19°·5 C. (Schiff.)

Specific Gravity.	Percentage of K_2CrO_4.	Specific Gravity.	Percentage of K_2CrO_4.	Specific Gravity.	Percentage of K_2CrO_4.	Specific Gravity.	Percentage of K_2CrO_4.
1·0080	1	1·0925	11	1·1864	21	1·2921	31
0161	2	1014	12	1964	22	3035	32
0243	3	1104	13	2066	23	3151	33
0325	4	1195	14	2169	24	3268	34
0408	5	1287	15	2274	25	3386	35
0492	6	1380	16	2379	26	3505	36
0576	7	1474	17	2485	27	3625	37
0663	8	1570	18	2592	28	3746	38
0750	9	1667	19	2700	29	3868	39
0837	10	1765	20	2808	30	3991	40

TABLE LXXIIc.—*continued.*

183. Specific Gravity, etc., of Sodium Dichromate Solutions. (Stanley.)

Specific Gravity.	Percentage of $Na_2Cr_2O_7$.	Specific Gravity.	Percentage of $Na_2Cr_2O_7$.	Specific Gravity.	Percentage of $Na_2Cr_2O_7$.
1·007	1	1·141	20	1·280	40
035	5	171	25	313	45
071	10	208	30	343	50
105	15	245	35		

184. Specific Gravity, etc., of Potassium Dichromate Solutions at 19°·5 C.

Percentage of $K_2Cr_2O_7$, ...	5 731	11·583
Specific Gravity, ...	1·0405	1·0847

185. Specific Gravity, etc., of Potassium Dichromate Solutions at 19°·5 C. (Gerlach, from Kremers.)

Specific Gravity.	Percentage of $K_2Cr_2O_7$.	Specific Gravity.	Percentage of $K_2Cr_2O_7$.	Specific Gravity.	Percentage of $K_2Cr_2O_7$.
1·007	1	1·043	6	1·080	11
015	2	050	7	087	12
022	3	056	8	095	13
030	4	065	9	102	14
037	5	073	10	110	15

186. Specific Gravity, etc., of Sodium Tungstate Solutions at 24°·5 C. (Franz.)

Specific Gravity.	Percentage of $Na_2WO_4 + 2H_2O$.	Specific Gravity.	Percentage of $Na_2WO_4 + 2H_2O$.	Specific Gravity.	Percentage of $Na_2WO_4 + 2H_2O$.	Specific Gravity.	Percentage of $Na_2WO_4 + 2H_2O$.
1·004	1	1·092	12	1·195	23	1·335	34
012	2	101	13	204	24	349	35
021	3	110	14	215	25	364	36
029	4	119	15	227	26	381	37
036	5	130	16	239	27	397	38
045	6	139	17	250	28	414	39
052	7	147	18	262	29	430	40
059	8	156	19	274	30	445	41
068	9	166	20	289	31	460	42
075	10	176	21	305	32	476	43
084	11	185	22	321	33	492	44

1 of $(Na_2WO_4 + 2H_2O)$ corresponds to 0·8909367 of Na_2WO_4.

TABLE LXXIIc.—*continued.*

187. Specific Gravity, etc., of Potassium Thiocarbonate Solutions at 15° C. (Delachanal.)

Specific Gravity.	Percentage of K_2CS_3.	Percentage of CS_2.	Specific Gravity.	Percentage of K_2CS_3.	Percentage of CS_2.
1·036	5·2	2·12	1·332	43·5	17·70
075	10·7	4·37	357	46·2	18·85
116	16·1	6·57	383	48·9	19·95
161	22·0	8·98	410	51·8	21·13
209	28·5	11·63	453	56·4	23·01
262	35·0	14·28	530	63·7	25·99
284	37·8	15·42	580	68·0	27·74
308	40·7	16·60			

188. Specific Gravity, etc., of Borax Solutions at 15° C. (Gerlach.)

Specific Gravity.	Percentage of	
	$Na_2B_4O_7+10H_2O$.	$Na_2B_4O_7$.
1·0049	1	0·5288
0099	2	1·0576
0149	3	1·5864
0199	4	2·1152
0249	5	2·6439
0299	6	3·1727

189. Specific Gravity, etc., of Sodium Phosphates Solutions. (Schiff.)

Percentage of Salt.	Specific Gravity for		Percentage of Salt.	Specific Gravity for		Percentage of Salt.	Specific Gravity for $Na_3PO_4+12H_2O$.
	$Na_2HPO_4+12H_2O$.	$Na_3PO_4+12H_2O$.		$Na_2HPO_4+12H_2O$.	$Na_3PO_4+12H_2O$.		
	19° C.	15° C.		19° C.	15° C.		15° C.
1	1·0041	1·0043	9	1·0376	1·0399	17	1·0778
2	0083	0086	10	0418	0455	18	0827
3	0125	0130	11	0460	0492	19	0876
4	0166	0174	12	0503	0539	20	0925
5	0208	0218	13	...	0586	21	0975
6	0250	0263	14	...	0633	22	1025
7	0292	0308	15	...	0681	23	1076
8	0332	0353	16	...	0729	24	1127

TABLE LXXIIc.—*continued.*

190. Specific Gravity, etc., of Potassium-dihydrogen Phosphate Solutions at 18° C. (Kohlrausch.)

Specific Gravity.	Percentage of KH_2PO_4.
1·0341	5
0691	10
1092	15

191. Specific Gravity, etc., of Sodium Arsenates Solutions. (Schiff.)

Percentage of Salt.	Specific Gravity for $Na_2HAsO_4 + 12H_2O$.	Specific Gravity for $Na_3AsO_4 + 12H_2O$.	Percentage of Salt.	Specific Gravity for $Na_2HAsO_4 + 12H_2O$.	Specific Gravity for $Na_3AsO_4 + 12H_2O$.	Percentage of Salt.	Specific Gravity for $Na_2HAsO_4 + 12H_2O$.
	14° C.	17° C.		14° C.	17° C.		
1	1·0042	1·0053	15	1·0665	1·0830	29	1·1358
2	0084	0107	16	0712	0887	30	1410
3	0126	0161	17	0759	0945	31	1463
4	0168	0215	18	0807	1003	32	1516
5	0212	0270	19	0855	1061	33	1569
6	0256	0325	20	0904	1120	34	1623
7	0300	0380	21	0953	1179	35	1677
8	0344	0435	22	1002	1238	36	1731
9	0389	0491	23	1052	...	37	1786
10	0434	0547	24	1102	...	38	1418
11	0479	0603	25	1153	...	39	1896
12	0525	0659	26	1204	...	40	1952
13	0571	0716	27	1255	...		
14	0618	0773	28	1306	...		

TABLE LXXIIc.—*continued.*

192. Specific Gravity, etc., of Solutions of various Acetates.

Percentage of Salt.	Specific Gravity for CH_3COONH_4. 16° C. (Hager.)	$CH_3COONa+3H_2O$. 17°·5 C. (Gerlach.)	CH_3COONa. 17°·5 C. (Gerlach.)	CH_3COOK. 17°·5 C. (Gerlach.)	$(CH_3COO)_2Ca$. 17°·5 C. (Hager.)	$(CH_3COO)_2Ba$. 15° C. (Franz.)	$(CH_3COO)_2Pb+3H_2O$. 15° C. (Gerlach.)	Corresponding Percentages of CH_3COONa. at 17·5 C.	$(CH_3COO)_2Pb$. at 15° C.
5	1·012	1·015	1·026	1·0245	1·0260	1·0436	1·0319	3·015	4·288
10	022	031	052	0490	0530	0758	0654	6·030	8·576
15	032	047	079	0740	0792	1120	1010	9·045	12·864
20	042	063	107	1005	1051	1522	1384	12·060	17·151
25	052	0795	136	1270	1321	1952	1784	15·075	21·439
30	062	0960	166	1545	1594	2402	2211	18·090	25·727
35	0695	1130	(31°) 1·172	1820		2954	2669	21·105	30·015
40	0770	1305		2105		3558	3163	24·120	34·303
45		1485		2390			3695	27·135	38·591
50	0920	1670		2685			4271	30·150	42·879
55				2980					
60				3285					

193. Specific Gravity, etc., of Ammonium Acetate Solutions at 16° C. (Hager.)

Specific Gravity.	Percentage of $NH_4C_2H_3O_2$.	Specific Gravity.	Percentage of $NH_4C_2H_3O_2$.	Specific Gravity.	Percentage of $NH_4C_2H_3O_2$.	Specific Gravity.	Percentage of $NH_4C_2H_3O_2$.
	1	1·030	14	1·056	27	1·0770	40
	2	032	15	058	28	0785	41
1·008	3	034	16	060	29	0800	42
010	4	036	17	062	30	0815	43
012	5	038	18	0636	31	0830	44
014	6	040	19	0651	32	0845	45
016	7	042	20	0666	33	0860	46
018	8	044	21	0681	34	0875	47
020	9	046	22	0695	35	0890	48
022	10	048	23	0710	36	0905	49
024	11	050	24	0725	37	0920	50
026	12	052	25	0740	38	0935	51
028	13	054	26	0755	39	0950	52

TABLE LXXIIc.—*continued.*

194. Specific Gravity, etc., of Sodium Acetate Solutions at 17°·5 C. (Gerlach.)

Specific Gravity.	Percentage of $NaC_2H_3O_2$.	Specific Gravity.	Percentage of $NaC_2H_3O_2$.	Specific Gravity.	Percentage of $NaC_2H_3O_2$.	Specific Gravity.	Percentage of $NaC_2H_3O_2$.
1·005	1	1·047	9	1·090	17	1·136	25
010	2	052	10	096	18	142	26
016	3	057	11	101	19	148	27
021	4	063	12	107	20	154	28
026	5	068	13	113	21	160	29
031	6	074	14	119	22	166	30
036	7	079	15	124	23	172	31
042	8	085	16	130	24		

195. Specific Gravity, etc., of Potassium Acetate Solutions at 17°·5 C. (Gerlach.)

Specific Gravity.	Percentage of $KC_2H_3O_2$.	Specific Gravity.	Percentage of $KC_2H_3O_2$.	Specific Gravity.	Percentage of $KC_2H_3O_2$.	Specific Gravity.	Percentage of $KC_2H_3O_2$.
1·0049	1	1·0793	16	1·1600	31	1·2449	46
0098	2	0846	17	1655	32	2508	47
0147	3	0899	18	1710	33	2567	48
0196	4	0952	19	1765	34	2626	49
0245	5	1005	20	1820	35	2685	50
0294	6	1058	21	1877	36	2744	51
0343	7	1111	22	1934	37	2803	52
0392	8	1164	23	1991	38	2862	53
0441	9	1217	24	2048	39	2921	54
0490	10	1270	25	2105	40	2980	55
0540	11	1325	26	2162	41	3041	56
0590	12	1380	27	2219	42	3102	57
0640	13	1435	28	2276	43	3163	58
0690	14	1490	29	2333	44	3224	59
0740	15	1545	30	2390	45	3285	60

196. Specific Gravity, etc., of Calcium Acetate Solutions at 17°·5 C. (Hager.)

Specific Gravity.	Percentage of $Ca(C_2H_3O_2)_2$.	Specific Gravity.	Percentage of $Ca(C_2H_3O_2)_2$.	Specific Gravity.	Percentage of $Ca(C_2H_3O_2)_2$.	Specific Gravity.	Percentage of $Ca(C_2H_3O_2)_2$.
1·0051	1	1·0475	9	1·0895	17	1·1321	25
0103	2	0530	10	0947	18	1375	26
0155	3	0582	11	0999	19	1430	27
0207	4	0634	12	1051	20	1484	28
0260	5	0686	13	1105	21	1539	29
0313	6	0739	14	1159	22	1594	30
0367	7	0792	15	1213	23		
0421	8	0843	16	1267	24		

TABLE LXXIIc.—*continued.*

197. Specific Gravity, etc., of Barium Acetate Solutions at 17°·5 C. (Franz.)

Specific Gravity.	Percentage of $Ba(C_2H_3O_2)_2$.	Specific Gravity.	Percentage of $Ba(C_2H_3O_2)_2$.	Specific Gravity.	Percentage of $Ba(C_2H_3O_2)_2$.	Specific Gravity.	Percentage of $Ba(C_2H_3O_2)_2$.
1·0087	1	1·0830	11	1·1608	21	1·2512	31
0174	2	0902	12	1694	22	2622	32
0261	3	0974	13	1780	23	2732	33
0348	4	1046	14	1866	24	2842	34
0436	5	1120	15	1952	25	2954	35
0500	6	1201	16	2042	26	3075	36
0564	7	1282	17	2132	27	3196	37
0628	8	1363	18	2222	28	3317	38
0692	9	1444	19	2312	29	3438	39
0758	10	1522	20	2402	30	3558	40

198. Specific Gravity, etc., of Lead Acetate Solutions at 15° C. (Gerlach.)

Specific Gravity.	Percentage of PbA_2+3H_2O.	Specific Gravity.	Percentage of PbA_2+3H_2O.	Specific Gravity.	Percentage of PbA_2+3H_2O.	Specific Gravity.	Percentage of PbA_2+3H_2O.
1·0064	1	1·0939	14	1·1955	27	1·3163	40
0127	2	1010	15	2040	28	3269	41
0191	3	1084	16	2126	29	3376	42
0255	4	1159	17	2211	30	3482	43
0319	5	1234	18	2303	31	3588	44
0386	6	1309	19	2395	32	3695	45
0453	7	1384	20	2486	33	3810	46
0520	8	1464	21	2578	34	3925	47
0587	9	1544	22	2669	35	4041	48
0654	10	1624	23	2768	36	4156	49
0725	11	1704	24	2867	37	4271	50
0796	12	1784	25	2966	38		
0867	13	1869	26	3064	39		

TABLE LXXIIc.—*continued.*

199. Specific Gravity, etc., of Lead Acetate Solutions at 20° C. (Salomon.) $Pb(C_2H_3O_2)_2 + 3H_2O$.

Grammes of Acetate in 100 c.cms.	Specific Gravity.	Grammes of Acetate in 100 c.cms.	Specific Gravity.	Grammes of Acetate in 100 c.cms.	Specific Gravity.	Grammes of Acetate in 100 c.cms.	Specific Gravity.
1	1·0062	14	1·0870	27	1·1663	40	1·2440
2	0124	15	0932	28	1723	41	2499
3	0186	16	0994	29	1783	42	2558
4	0248	17	1056	30	1844	43	2617
5	0311	18	1118	31	1903	44	2676
6	0373	19	1180	32	1963	45	2735
7	0435	20	1242	33	2022	46	2794
8	0497	21	1302	34	2082	47	2853
9	0559	22	1362	35	2142	48	2912
10	0622	23	1422	36	2201	49	2971
11	0684	24	1482	37	2261	50	3030
12	0746	25	1543	38	2320		
13	0808	26	1603	39	2380		

200. Specific Gravity, etc., of Potassium Oxalates Solutions at 17°·5 C. (Franz.)

Percentage of Salt.	Specific Gravity for			Percentage of Salt	Specific Gravity for
	$K_2C_2O_4 + H_2O$.	$KHC_2O_4 + H_2O$.	$KH_3(C_2O_4)_2 + 2H_2O$.		$K_2C_2O_4 + H_2O$.
1	1·0068	1·0055	1·0047	14	1·0912
2	0134	0110	0093	15	0977
3	0201	0164		16	1043
4	0268	0218		17	1109
5	0337	0271		18	1175
6	0401			19	1241
7	0465			20	1306
8	0529			21	1372
9	0593			22	1438
10	0656			23	1504
11	0720			24	1570
12	0784			25	1637
13	0848				

TABLE LXXIIc.—*continued.*

201. Specific Gravity, etc., of Tartar-emetic Solutions at 17°·5 C. (Streit.)

Specific Gravity.	Percentage of $KSbOC_4H_4O_6+\frac{1}{2}H_2O$.
1·005	0·5
007	1
012	2
018	3
027	4
035	5
041	6

202. Specific Gravity, etc., at 17°·5 C. of Solutions of Alkaline Tartrates. (Gerlach.)

Potassium Tartrate.		Potassium Sodium Tartrate.		
Specific Gravity.	Percentage of $K_2C_4H_4O_6$.	Specific Gravity.	Percentage of $NaKC_4H_4O_6$.	Percentage of $NaKC_4H_4O_6+4H_2O$.
1·0000	0	1·0000	0	0
0650	10	0510	7·448	10
1350	20	1050	14·896	20
2110	30	1620	22·344	30
2930	40	2230	29·729	40
3815	50	2890	37·240	50

203. Specific Gravity, etc., at 19°·5 of Solutions of Alkaline Tartrates. (Kremers.)

Percentage of Salt.	Specific Gravity for Solutions of		
	Potassium Tartrate Cryst.	Sodium Tartrate Cryst.	Sodium Potassium Tartrate Cryst.
5	1·032	1·030	1·025
10	063	060	050
15	097	093	078
20	133	125	105
25	170	157	134
30	208	192	162
35	249	228	193
40	290	255	224
45	335		255
50	380		287
55	426		321
60	476		
65	533		

TABLE LXXIIc.—*continued.*

204. Specific Gravity, etc., of Barium Hydroxide Solutions. (Dalton.)

Sp. Gr., . . .	1·01	1·02	1·03	1·3	1·6
Percentage of BaO, .	0·9	1·8	2·6	19	30

205. Specific Gravity, etc., of Sodium Phosphotungstate Solutions at 20° C. (Brandhorst and Kraut.)

$$(Na_2O)_2.P_2O_5(WO_3)_{24} + 27H_2O.$$

(*a*)

Sp. Gr.	Percentage of Crystallised Salt.
1·085	10·22
190	20·94
316	31·14
496	42·61
702	52 92
2·001	64·11

(*b*)

Percentage of Salt.	Specific Gravity for	
	Anhydrous Salt.	Crystallised Salt.
5	1·044	1·040
10	092	084
15	143	131
20	199	181
25	262	237
30	333	299
35	414	370
40	507	449
45	613	538
50	734	640
55	872	754
60		884
64		998

TABLE LXXIIc.—*continued.*

206. Specific Gravity of Carbon Disulphide Solutions of Sulphur at 15° C. (Macagno.)

Sp. Gr.	% S.	Sp. Gr.	% S.	Sp. Gr.	% S.	Sp. Gr.	% S.	Sp. Gr.	% S.	Sp. Gr.	% S.
1·271	0·0	1·293	5·3	1·315	10·6	1·337	15·9	1·359	21·5	1·381	30·8
272	0·2	294	5·6	316	10·9	338	16·1	360	21·8	382	31·4
273	0·4	295	5·8	317	11·1	339	16·4	361	22·1	383	31·9
274	0·6	296	6·0	318	11·3	340	16·6	362	22·3	384	32·6
275	0·9	297	6·3	319	11·6	341	16·9	363	22·7	385	33·2
276	1·2	298	6·5	320	11·8	342	17·1	364	23·0	386	33·8
277	1·4	299	6·7	321	12·1	343	17·4	365	23·2	387	34·5
278	1·6	300	7·0	322	12·3	344	17·6	366	23·6	388	35·2
279	1·9	301	7·2	323	12·6	345	17·9	367	24·0	389	36·1
280	2·1	302	7·5	324	12·8	346	18·1	368	24·3	390	36·7
281	2·4	303	7·8	325	13·1	347	18·4	369	24·8	391	37·2
282	2·6	304	8·0	326	13·3	348	18·6	370	25·1		
283	2·9	305	8·2	327	13·5	349	18·8	371	25·6		
284	3·1	306	8·5	328	13·8	350	19·0	372	26·0		
285	3·4	307	8·7	329	14·0	351	19·3	373	26·5		
286	3·6	308	8·9	330	14·2	352	19·6	374	26·9		
287	3·9	309	9·2	331	14·5	353	19·9	375	27·4		
288	4·1	310	9·4	332	14·7	354	20·1	376	28·1		
289	4·4	311	9·7	333	15·0	355	20·4	377	28·5		
290	4·6	312	9·9	334	15·2	356	20·7	378	29·0		
291	4·8	313	10·2	335	15·4	357	21·0	379	29·7		
292	5·1	314	10·4	336	15·6	358	21·2	380	30·2		

207. Specific Gravities, etc., of Solutions of Albumen at 15°·5 C.

Percentage.	Degrees Baumé.	Sp. Gr.	Percentage.	Degrees Baumé.	Sp. Gr.	Percentage.	Degrees Baumé.	Sp. Gr.
1	0·37	1·0026	**15**	5·32	1·0384	**40**	13·78	1·1058
2	0·77	0054	**20**	7·06	0515	**45**	15·48	1204
3	1·12	0078	**25**	8·72	0644	**50**	17·16	1352
5	1·85	0130	**30**	10·42	0780	**55**	18·90	1511
10	3·66	0261	**35**	13·12	0919			

TABLE LXXIID.—(1) **Solubilities of various Compounds at various Temperatures.**

$t°$ C.	Potassium Chloride, KCl.		Ammonium Chloride, NH_4Cl.		Calcium Chloride, $CaCl_2$.		Strontium Chloride, $SrCl_2$.		Strontium Chloride, $SrCl_2 + 2H_2O$.		Barium Chloride, $BaCl_2$.		Barium Chloride, $BaCl_2 + 2H_2O$.		Cadmium Chloride, $CdCl_2$.	
	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.
0°	28·5	3·51	28·40	3·52	49·6	2·016	44·2	2·26	60·3	1·66	30·9	3·24				
5	30·3	3·30	30·62	3·27	54	1·852	46·0	2·17			32·2	3·11				
10	32	3·13	32·84	3·04	60	1·667	48·3	2·07	66·6	1·50	33·3	3·00	41·5	2·41		
15	33·4	2·99	35·06	2·82	66	1·515	51·0	1·96			34·5	2·90				
20	34·7	2·88	37·28	2·68	74	1·351	53·9	1·86	75·5	1·33	35·7	2·80	44·6	2·24	141	0·71
25	36·1	2·77	39·50	2·53	82	1·220	56·9	1·76			37·0	2·70				
30	37·4	2·67	41·72	2·40	93	1·075	60·0	1·67			38·2	2·62				
35	38·8	2·58	43·94	2·28	104	0·962	63·2	1·58			39·5	2·53				
40	40·1	2·49	46·16	2·17	110	0·909	66·7	1·50			40·7	2·46			139	0·72
45	41·5	2·41	48·38	2·07	115	0·869	70·4	1·42			42·2	2·37				
50	42·8	2·33	50·60	1·98	120	0·833	74·4	1·34			43·6	2·29				
55	44·2	2·26	52·82	1·89	125	0·800	78·7	1·27			45·0	2·22				
60	45·5	2·20	55·04	1·82	129	0·775	83·1	1·20	126·0	0·79	46·4	2·16	59·1	1·69	139	0·72
65	46·9	2·13	57·26	1·75	133	0·752	87·5	1·14			47·9	2·09				
70	48·3	2·07	59·48	1·68	136	0·735	89·6	1·12			49·4	2·02				
75	49·7	2·01	61·70	1·62	139	0·719	90·9	1·10			50·9	1·96				
80	51·0	1·96	63·92	1·56	142	0·704	92·4	1·08			52·4	1·91			143	0·70
85	52·4	1·91	66·14	1·51	144	0·694	94·1	1·06			54·0	1·85				
90	53·8	1·86	68·36	1·46	147	0·680	96·2	1·04			55·6	1·80				
95	55·2	1·81	70·58	1·41	(99°) 154	0·649	98·8	1·01			57·2	1·75				
100	56·6	1·77	72·80	1·37			101·9	0·98	162·9	0·61	58·8	1·70	76·9	1·30	149	0·67

TABLE LXXIIB. I—*continued*.

$t°$ C.	Mercuric Chloride, $HgCl_2$: Weight in 100 parts of Water.	Mercuric Chloride, $HgCl_2$: Weight of Water to dissolve 1 part Salt.	Sodium Bromide, $NaBr$: Weight in 100 parts of Water.	Sodium Bromide, $NaBr$: Weight of Water to dissolve 1 part Salt.	Potassium Bromide, KBr: Weight in 100 parts of Water.	Potassium Bromide, KBr: Weight of Water to dissolve 1 part Salt.	Calcium Bromide, $CaBr_2$: Weight in 100 parts of Water.	Calcium Bromide, $CaBr_2$: Weight of Water to dissolve 1 part Salt.	Barium Bromide, $BaBr_2.2H_2O$: Weight in 100 parts of Water.	Barium Bromide, $BaBr_2.2H_2O$: Weight of Water to dissolve 1 part Salt.	Sodium Iodide, NaI: Weight in 100 parts of Water.	Sodium Iodide, NaI: Weight of Water to dissolve 1 part Salt.	Potassium Iodide, KI: Weight in 100 parts of Water.	Potassium Iodide, KI: Weight of Water to dissolve 1 part Salt.	Strontium Iodide, SrI_2: Weight in 100 parts of Water.	Strontium Iodide, SrI_2: Weight of Water to dissolve 1 part Salt.
0	5·73	17·50	77·5	1·29	53·48	1·87	125	0·80			158·7	0·63	127·8	0·78	164	0·61
5					56·28	1·78					163·6	0·61	132·0	0·76		
10	6·57	15·22			59·16	1·69					168·6	0·59	136·1	0·73		
15					61·94	1·61					173·7	0·58	140·2	0·71		
20	7·39	13·53	88·4	1·13	64·60	1·55	145	0·70	133	0·75	178·6	0·56	144·2	0·69	179	0·56
25					67·20	1·49							148·2	0·67		
30	8·43	11·86			69·69	1·43							152·1	0·65		
35					72·19	1·37							156·1	0·64		
40	9·62	10·40	104·2	0·96	74·62	1·34	213	0·47			208·4	0·48	160·0	0·63	196	0·51
45					77·15	1·29							164	0·61		
50					79·69	1·25							168	0·60		
55					82·22	1·21							172	0·58		
60	13·86	7·22	111·1	0·90	84·74	1·18	278	0·36	161	0·62	256·4	0·39	176	0·57		
65					87·04	1·15							180	0·56		
70					89·24	1·12							184	0·54	250	0·40
75					91·35	1·09							188	0·53		
80	24·30	4·12	112·2	0·89	93·46	1·07					303·0	0·33	192	0·52		
85					95·61	1·04							196·2	0·50		
90					97·76	1·02							200·4	0·49		
95					99·90	1·00							204·7	0·49		
100	53·96	1·85	114·9	0·87	102·04	0·98			204	0·49	312·5	0·32	209	0·48	370	0·27
105							312	0·32					213·6	0·47		
110													218	0·46		
120											322·5	0·31				
140											333·3	0·30				

TABLE LXXIID. 1—*continued*.

$t°$	Cadmium Iodide, CdI_2.		Lithium Nitrate, $LiNO_3$.		Sodium Nitrate, $NaNO_3$.		Potassium Nitrate, KNO_3.		Rubidium Nitrate, $RbNO_3$		Strontium Nitrate, $Sr(NO_3)_2$.		Barium Nitrate, $Ba(NO_3)_2$.		Lead Nitrate, $Pb(NO_3)_2$.	
	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.
0°			48·3	2·07	72·9	1·37	13·3	7·52	20·1	5	39·5	·56	5·0	20·00	38·7	2·58
5					77·4	1·29	17·2	5·81			47·3	2·11	6	16·67		
10					80·8	1·24	21·1	4·74	43·5	2·3	54·9	1·82	7·0	14·29	48·3	2·07
15					84·0	1·19	26·1	3·83			62·8	1·59	8·1	12·35		
20	92·6	1·08	75·7	1·32	87·5	1·14	31·2	3·20			70·8	1·41	9·2	10·87	56·4	1·77
25					91·0	1·10	37·8	2·65			79·0	1·27	10·4	9·62		
30					94·9	1·05	44·5	2·25			87·6	1·14	11·6	8·62	65·5	1·53
35					99	1·01	54·2	1·85			90·6	1·10	12·8	7·81		
40	100	1·00	169·4	0·59	102	0·98	64·0	1·56			91·3	1·09	14·2	7·04	75·2	1·33
45					107	0·93	74·9	1·35			91·9	1·09	15·6	6·41		
50					112	0·89	85·9	1·16			92·6	1·08	17·1	5·85	85·1	1·17
55					117	0·85	97·3	1·03			93·4	1·07	18·7	5·35		
60	107·5	0·93			122	0·82	110·9	0·90			94·0	1·06	20·3	4·92		
65					128	0·78	124·9	0·80			94·8	1·05	21·9	4·57		
70			196·1	0·51	134	0·75	139	0·72			95·6	1·05	23·6	4·24	105·8	0·95
75					140	0·71	155	0·65			96·4	1·04	25·4	3·99		
80	116·3	0·86			148	0·68	172	0·58			97·2	1·03	27·0	3·70		
85					155	0·65	189	0·53			98	1·02	28·8	3·47		
90					162	0·62	206	0·49			99	1·01	30·6	3·27		
95					171	0·58	226	0·44			100	1·00	32·4	3·09		
100	133·3	0·75	227·3	0·44	180	0·56	247	0·40			101·2	0·99	34·2	2·92	138·9	0·72
105					190	0·53	274	0·36								
110			256·4	0·39	200	0·50	301	0·33								

TABLE LXXIId. 1—*continued.*

$t°$ C.	Sodium Chlorate, $NaClO_3$.		Barium Chlorate, $Ba(ClO_3)_2 H_2O$.		Barium Chlorate, $Ba(ClO_3)_2$.		Sodium Bromate, $NaBrO_3$.		Potassium Bromate, $KBrO_3$.		Sodium Iodate, $NaIO_3$.		Potassium Iodate, KIO_3.		Potassium Perchlorate, $KClO_4$.	
	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.
0°	81·9	1·22	24·5	4·08	22·8	4·39	27·54	3·63	3·11	32·13	2·52	39·75	4·74	21·11	0·70	142·9
5	86·0															
10	90·1															
15	94·5															
20	99·0	1·01	40·2	2·49	37·0	2·70	34·48	2·61	6·92	14·44	9·07	11·03	8·14	12·29		
25	105·1															
30	111·8															
35	117·4															
40	123·5	0·81			52·1	1·92	50·25	1·99	13·24	7·55	14·39	6·95	12·88	7·76		
45	129·4															
50	135·3														6·45	15·5
55	141·2															
60	147·1	0·68	86·2	1·16	77·5	1·29	62·50	1·60	22·76	4·39	20·88	4·79	18·52	5·40		
65	154·2															
70	161·4															
75	168·5															
80	175·6	0·57			98	1·02	75·75	1·32	33·90	2·95	27·70	3·61	24·88	4·02		
85	182·7															
90	189·9															
95	197·0															
100	204·1	0·49	145·0	0·69	126·4	0·79	90·90	1·10	49·75	2·01	33·90	2·95	32·26	3·10	19·90	5·04
110																
120	333·3	0·300														

TABLE LXXIID. 1—*continued.*

$t°$ C.	Calcium Oxide, CaO. Weight in 100 parts of Water.	Calcium Oxide, CaO. Weight of Water to dissolve 1 part Salt.	Strontium Oxide, SrO. Weight in 100 parts of Water.	Strontium Oxide, SrO. Weight of Water to dissolve 1 part Salt.	Strontium Hydroxide, $Sr(HO)_2.8H_2O$. Weight in 100 parts of Water.	Strontium Hydroxide, $Sr(HO)_2.8H_2O$. Weight of Water to dissolve 1 part Salt.	Barium Hydroxide, $Ba(HO)_2$. Weight in 100 parts of Water.	Barium Hydroxide, $Ba(HO)_2$. Weight of Water to dissolve 1 part Salt.	Barium Hydroxide, $Ba(HO)_2.8H_2O$. Weight in 100 parts of Water.	Barium Hydroxide, $Ba(HO)_2.8H_2O$. Weight of Water to dissolve 1 part Salt.	Hydrogen Borate, H_3BO_3. Weight in 100 parts of Water.	Hydrogen Borate, H_3BO_3. Weight of Water to dissolve 1 part Salt.	Sodium Tetraborate, $Na_2B_4O_7$. Weight in 100 parts of Water.	Sodium Tetraborate, $Na_2B_4O_7$. Weight of Water to dissolve 1 part Salt.	Sodium Tetraborate, $Na_2B_4O_7.10H_2O$. Weight in 100 parts of Water.	Sodium Tetraborate, $Na_2B_4O_7.10H_2O$. Weight of Water to dissolve 1 part Salt.
0°	0·1382		0·35	286	0·903	110·7					1·95	51·28	1 49	67·11	2·83	35·43
5																
10	0·1343						2·22	45·04	4·69	21·32			2·42	41·32	4·65	21·50
15	0·1300															
20			0·70	143	1·820	55·0	3·48	28·74	7·43	13·45	3·99	25·06	4·05	24·69	7·88	12·69
25																
30	0·1163												6·00	16·67		
35																
40							7·36	13·58	16·42	6·09	6·99	14·31	8·79	11·38	17·90	5·48
45	0·1006															
50			2·18	45·8	5·790	17·3					9·80	10·20	12·93	7·73		
55																
60	0·0869						18·76	5·33	48·08	2·08			18·09	5·53	40·43	2·47
65																
70													24·22	4·13		
75			5·58	17·9	15·68	6·4										
80							90·77	1·10	3875·	0·026	16·82	5·94	31·17	3·21	76·19	1·31
85																
90													40·14	2·49		
95																
100	0·0577										34·00	2·94	55·16	1·81	201·43	0·49

TABLE LXXIID. 1—*continued.*

$t°$ C.	Sodium Hydrogen Carbonate, $NaHCO_3$. Weight in 100 parts of Water.	Sodium Hydrogen Carbonate, $NaHCO_3$. Weight of Water to dissolve 1 part Salt.	Sodium Carbonate, Na_2CO_3. Weight in 100 parts of Water.	Sodium Carbonate, Na_2CO_3. Weight of Water to dissolve 1 part Salt.	Sodium Carbonate, $Na_2CO_3.10H_2O$. Weight in 100 parts of Water.	Sodium Carbonate, $Na_2CO_3.10H_2O$. Weight of Water to dissolve 1 part Salt.	Potassium Hydrogen Carbonate, $KHCO_3$. Weight in 100 parts of Water.	Potassium Hydrogen Carbonate, $KHCO_3$. Weight of Water to dissolve 1 part Salt.	Potassium Carbonate, K_2CO_3. Weight in 100 parts of Water.	Potassium Carbonate, K_2CO_3. Weight of Water to dissolve 1 part Salt.	Potassium Hydrogen Oxalate, KHC_2O_4. Weight in 100 parts of Water.	Potassium Hydrogen Oxalate, KHC_2O_4. Weight of Water to dissolve 1 part Salt.	Ammonium Oxalate, $(NH_4)_2C_2O_4.H_2O$. Weight in 100 parts of Water.	Ammonium Oxalate, $(NH_4)_2C_2O_4.H_2O$. Weight of Water to dissolve 1 part Salt.	Ammonium Carbonate. Weight in 100 parts of Water.	Ammonium Carbonate. Weight of Water to dissolve 1 part Salt.
0°	6·9	14·49	7·1	14·08	21·33	4·69	22·45	4·454	89·4	1·12	2·2	45·45				
5	7·53		9·5	10·52					104	0·96						
10	8·15	12·27	12·6	7·94	40·94	2·44	27·7	3·610	109	0·91	3·1	32·26				
15	8·88		16·5	6·06					110	0·90					25	4
20	9·6	10·42	21·4	4·67	92·82	1·08	33·2	3·012	112	0·89	5·2	19·23	7·05	14·2		
25	10·35		28·0	3·57	149·13	0·67			113	0·88						
30	11·1	9·09	38·1	2·62	273·64	0·36	39·0	2·564	114	0·88						
35	11·9		46·2	2·16					115	0·87						
40	12·7	7·87	46·2	2·16			45·25	2·210	117	0·85	10·5	9·52	9·74	10·3		
45	13·57		46·2	2·16					119	0·84						
50	14·45	6·92	46·2	2·16			52·15	1·917	121	0·83						
55	15·42		46·2	2·16					124	0·81						
60	16·4	6·10	46·2	2·16			60·0	1·667	127	0·79	20·5	4·88	16·52	6·05		
65			46·2	2·16					130	0·77					66·6	1·5
70			46·2	2·16					133	0·75						
75			46·2	2·16					137	0·73						
80			46·1	2·17					140	0·71	34·7	2·88	27·66	3·62		
85			45·9	2·18					144	0·69						
90			45·7	2·19					147	0·68						
95			45·6	2·20					151	0·66						
100			45·4	2·203					156	0·64	51·5	1·94	41·34	2·42		
110									167	0·60						
120									181	0·55						

TABLE LXXIID. 1—*continued.*

$t°$ C.	Lithium Sulphate, Li_2SO_4.		Lithium Sulphate, $Li_2SO_4.H_2O$.		Sodium Sulphate, $Na_2SO_4.10H_2O$.		Potassium Bisulphate, $K_2S_2O_7$.		Potassium Sulphate, K_2SO_4.		Ammonium Sulphate, $(NH_4)_2SO_4$.		Magnesium Sulphate, $MgSO_4$.		Magnesium Sulphate, $MgSO_4.7H_2O$.	
	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.
0°	35·34	2·83	43·52	2·29	12·16	8·224	33·9	2·95	8·5	11·76	71·00	1·408	26·9	3·717	76·9	1·300
5									9·1	10·99			29·3	3·413		
10					23·04	4·340			9·7	10·31	73·65	1·358	31·5	3·174	96·5	1·036
15									10·3	9·71			33·8	2·959		
20	34·36	2·91	42·37	2·36	(18°) 48·41	2·065	48·8	2·08	10·9	9·17	76·30	1·311	36·2	2·762	119·8	0·836
25					98·48	1·015			11·6	8·62			38·5	2·623		
30					184·1	0·543			12·3	8·13	78·95	1·266	40·9	2·445		
35									13·1	7·63			43·3	2·309		
40							62·9	1·59	14·0	7·15	81·60	1·225	45·6	2·193	179·5	0·557
45	32·38	3·09							14·9	6·71			48·0	2·042		
50									15·8	6·33	84·25	1·187	50·3	1·988		
55									16·8	5·95			52·7	1·898		
60									17·8	5·62	86·90	1·150	55·0	1·818		
65	30·3	3·30							18·8	5·32			57·3	1·745		
70									19·8	5·05	89·55	1·116	59·6	1·678	326·8	0·306
75									20·8	4·92			61·9	1·615		
80									21·8	4·59	92·20	1·085	64·2	1·558		
85									22·8	4·39			66·5	1·504		
90									23·9	4·18	94·85	1·054	68·9	1·451		
95									25·0	4·00			71·4	1·401		
100	29·24	3·42	35·75	2·80			113·6	0·88	26·2	3·82	97·50	1·026	73·8	1·355	671·2	0·149

TABLE LXXIId. 1—*continued.*

t° C.	Aluminium Sulphate, $Al_2(SO_4)_3.18H_2O$.		Ammonium Alum, $(NH_4)_2Al_2(SO_4)_4 + 24H_2O$.		Potassium Alum, $K_2Al_2(SO_4)_4 + 24H_2O$.		Manganese Sulphate, $MnSO_4$.		Nickel Sulphate, $NiSO_4$.		Nickel Sulphate, $NiSO_4.7H_2O$.		Cobalt Sulphate, $CoSO_4$.		Cobalt Sulphate, $CoSO_4.7H_2O$.	
	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.
0°	86·85	1·151	5·22	19·16	3·90	25·64	55·4	1·805								
5							58·2	1·718								
10	95·8	1·052	9·16	10·92	9·52	10·50	61·1	1·652								
15							63·8	1·567								
20	107·3	0·932	13·66	7·32	15·13	6·61	66·3	1·508	39·7	2·52	106·3	0·94	36·4	2·75	94·0	1·07
25							68·5	1·460								
30	127·6	0·784	19·29	5·18	22·01	4·55	70·4	1·420								
35							71·9	1·391								
40	167·6	0·597	27·27	3·67	30·92	3·23	73·1	1·367								
45							74·0	1·351								
50	201·4	0·494	36·51	2·74	44·11	2·26	74·8	1·337					55·2	1·81	182·7	0·55
55							74·7	1·339								
60	262·6	0·381	51·29	1·95	66·65	1·50	65·9	1·517								
65							61·5	1·626								
70	348·2	0·287	71·97	1·39	90·67	1·10	61·5	1·626	61·9	1·62	226·4	0·442	65·7	1·52		
75							61·5	1·626								
80	467·3	0·212	103·08	0·97	134·47	0·74	61·5	1·626								
85							61·3	1·631								
90	678·8	0·147	187·82	0·53	209·31	0·48	60·3	1·658								
95							57·9	1·727								
100	1132·0	0·088	421·90	0·24	357·48	0·28	52·9	1·890								

TABLE LXXIId. 1—*continued.*

$t°$ C.	Copper Sulphate, $CuSO_4$.		Copper Sulphate, $CuSO_4.5H_2O$.		Zinc Sulphate, $ZnSO_4.7H_2O$.		Sodium Sulphite, Na_2SO_3.		Sodium Phosphate, Na_2HPO_4.		Sodium Phosphate, $Na_2HPO_4.12H_2O$.		Sodium Pyrophosphate, $Na_4P_2O_7$.		Sodium Pyrophosphate, $Na_4P_2O_7.10H_2O$.	
	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.
0°	14·15	7·067	31·61	3·163	115·22	0·868	14·1	7·07	2·5	40·0			3·16	31·64	5·41	18·49
5			34·28	2·917					2·8	35·71						
10	17·50	5·714	36·95	2·706	138·21	0·724			3·9	25·64			3·95	25·32	6·81	14·68
15			39·63	2·524					5·8	17·24	14·93	6·7				
20	20·53	4·870	42·31	2·364	161·49	0·619	25·8	3·49	9·3	10·75	17·24	5·8	6·23	16·05	10·92	9·16
25			45·56	2·195					15·4	6·49	31·25	3·2				
30	24·34	4·108	48·81	2·048	190·90	0·524			24·1	4·15			9·95	10·05	18·11	5·52
35									39·3	2·54						
40	28·50	3·509	56·90	1·757	224·05	0·446	49·5	2·02	63·9	1·56			13·50	7·42	24·97	4·00
45									74·8	1·34						
50	33·31	3·002	65·83	1·519	263·84	0·379			82·5	1·21			17·45	5·73	33·25	3·01
55									87·7	1·14						
60	39·01	2·563	77·39	1·292	313·48	0·319			91·6	1·09			21·83	4·58	44·07	2·27
65									93·8	1·07						
70	45·74	2·186	94·00	1·064	369·36	0·277			95·0	1·05			25·62	3·90	52·11	1·92
75									95·8	1·04						
80	54·53	1·834	118·03	0·847	442·62	0·226			96·6	1·03			30·04	3·33	63·40	1·58
85									97·2	1·03						
90	64·35	1·554	156·44	0·639	533·02	0·188			97·8	1·02			35·11	2·85	77·47	1·29
95									98·4	1·01						
100	75·22	1·329	203·32	0·491	653·59	0·153			(99°) 98·8	1·01			40·26	2·48	93·11	1·07
105									82·5	1·21						

TABLE LXXIId. 1—*continued.*

$t°$ C.	Lithium Chloride, $LiCl$.		Lithium Iodide, LiI.		Potassium Dichromate, $K_2Cr_2O_7$.		Sodium Dichromate, $Na_2Cr_2O_7$.		Potassium Thiocyanate, $KCNS$.		Ammonium Thiocyanate, NH_4CNS.		Selenium Dioxide, SeO_2.		Sulphur Dioxide, SO_2.	
	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts of Water.	Weight of Water to dissolve 1 part Salt.
0°	63·7	1·57	151	0·66	4·6	21·74	107·2	0·933	177·2	0·564	122·1	0·819	89·7	1·115	23·6	4·23
5															19·3	5·18
10					7·4	13·51									15·4	6·49
15							109·2	0·916								
20	80·7	1·24	(19°) 164	0·61	12·4	8·06			217·0	0·46	162·2	0·616	168·1	0·595	10·4	9·61
25																
30					18·4	5·43	116·6	0·857								
35																
40			179	0·56	25·9	3·86										
45																
50					35·0	2·86										
55																
60			(59°) 200	0·50	45·0	2·22										
65	104·2	0·96														
70					56·7	1·76										
75			263	0·38												
80	115·0	0·87	435	0·23	68·6	1·56	142·8	0·700								
85																
90					81·1	1·23										
95	(96°) 129·0	0·78														
100			(99°) 476	0·21	94·1	1·06	162·8	0·614								
120			588	0·17												
140	139·0	0·72					(139°) 209·7	0·477								
160	145·0	0·69														

TABLE LXXIId. 1—*continued.*

C.	Sodium Thiosulphate, $Na_2S_2O_3.5H_2O$.		Sodium Sulphate, $Na_2SO_4.7H_2O$.		Potassium Hydrogen Tartrate, $KHC_4H_4O_6$.		Potassium Selenate, K_2SeO_4.		Rubidium Hydrogen Tartrate, $RbHC_4H_4O_6$.		Caesium Hydrogen Tartrate, $CsHC_4H_4O_6$.		Sodium Chloride, NaCl.	
	Weight in 100 parts Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts Water.	Weight of Water to dissolve 1 part Salt.	Weight in 100 parts Water.	Weight of Water to dissolve 1 part Salt.
													(−15°) 32·73	3·005
0°			44·89	2·450	0·370	270·3	110·5	0·905					35·52	2·815
5														
10			78·9	1·267										
15	(16°) 162	0·62	105·8		0·411	243·3							(14°) 35·87	2·788
20			140·0	0·945			112·8	0·887						
25	206	0·49	188·5	0·530	0·845	118·3			1·18	84·5	9·7	10·3	36·13	2·768
30					1·024	97·6								
35	283	0·35												
40					1·461	68·4							36·64	2·742
45	450	0·22												
50					1·954	51·2								
55														
60													37·25	2·685
65														
70														
75														
80					4·166	24·0							38·22	2·616
85														
90														
95														
100					6·102	16·4	122·2	0·818	11·76	8·5	98·0	1·02	39·61	2·525
110													(109·7°) 40·35	2·478

TABLE LXXIId. 1—*continued.*

$t°$ C.	Calcium Iodide, CaI_2. Weight in 100 parts Water.	Calcium Iodide, CaI_2. Weight of Water to dissolve 1 part Salt.	Ammonium Bromide, NH_4Br. Weight in 100 parts Water.	Ammonium Bromide, NH_4Br. Weight of Water to dissolve 1 part Salt.	Lead Acetate, $Pb(C_2H_3O_2)_2.3H_2O$. Weight in 100 parts Water.	Lead Acetate, $Pb(C_2H_3O_2)_2.3H_2O$. Weight of Water to dissolve 1 part Salt.	Bromine, Br_2. Weight in 100 parts Water.	Bromine, Br_2. Weight of Water to dissolve 1 part Salt.	Magnesium Chloride, $MgCl_2+6H_2O$. Weight in 100 parts Water.	Magnesium Chloride, $MgCl_2+6H_2O$. Weight of Water to dissolve 1 part Salt.	Magnesium Chloride, $MgCl_2$. Weight in 100 parts Water.	Magnesium Chloride, $MgCl_2$. Weight of Water to dissolve 1 part Salt.	Sodium Tungstate, $Na_2WO_4.2H_2O$. Weight in 100 parts Water.	Sodium Tungstate, $Na_2WO_4.2H_2O$. Weight of Water to dissolve 1 part Salt.
0°	192	0·52											40·98	2·44
5							3·73	26·8						
10			66·2	1·51			3·44	29·1						
15			(16°) 71·9	1·39			3·33	30·0					55·24	1·81
20	204	0·49					3·31	30·2						
25							3·26	30·6	364·7	0·27	57·95	1·72		
30			81·3	1·23			3·22	31·0						
35														
40	228	0·44			100	1·00			416·5	0·24	60·64	1·64		
45	(43°) 286	0·35												
50			94·3	1·06										
55														
60									485·6	0·20	64·10	1·56		
65														
70														
75														
80									558·6	0·17	65·87	1·51		
85														
90														
95	(92°) 435	0·23												
100			128·2	0·78	200	0·50							123·4	0·81

TABLE LXXIID. 2.—**Solubilities of various Compounds at various Temperatures up to 100° C.**

a. Weight of Compound dissolved in 100 grms. of Water. *b.* Weight of Water required to dissolve 1 grm. of Compound.

t° C.	NH_4Cl.		NaCl.		KCl.		$CaCl_2$.		$SrCl_2$.		$BaCl_2$.		KI.		NH_4NO_3.	
	a	*b*	*a*	*b*	*a*	*b*	*a*	*b*	*a*	*b*	*a*	*b*	*a*	*b*	*a*	*b*
0°	29·7	3·367	35·7	2·801	28·5	3·509	49·6	2·016	44·2	2·262	30·9	3·236	127·9	...	97	1·031
1	30·0	333	35·7	801	28·7	484	50	000	44·5	247	31·2	213	128·7	0·777	101	0·990
2	30·3	300	35·7	800	29·0	448	51	1·961	44·8	232	31·5	190	129·6	772	105	952
3	30·6	268	35·7	800	29·3	413	52	923	45·2	212	31·7	168	130·4	767	109	917
4	31·0	226	35·7	799	29·5	390	53	887	45·6	193	31·9	145	131·2	762	113	885
5	31·4	185	35·7	798	30·0	333	54	852	46·0	174	32·2	122	132·1	757	117	855
6	31·8	145	35·7	797	30·5	279	55	818	46·5	151	32·4	100	132·9	752	121	826
7	32·2	106	35·7	796	31·0	226	56	788	46·9	131	32·6	077	133·7	748	125	800
8	32·6	067	35·7	795	31·5	175	57	755	47·4	110	32·8	055	134·5	743	130	769
9	33·0	030	35·7	794	31·7	155	58	724	47·8	092	33·1	032	135·3	739	134	746
10	33·3	003	35·8	793	32·0	125	60	689	48·3	072	33·3	009	136·1	734	139	719
11	33·7	2·967	35·8	791	32·3	096	61	639	48·8	050	33·5	2·987	137·0	730	143	697
12	34·1	933	35·8	789	32·5	077	62	613	49·4	025	33·8	964	137·8	726	148	676
13	34·5	899	35·8	788	32·8	049	63	587	49·9	001	34·0	942	138·6	722	152	657
14	34·8	874	35·8	787	33·1	021	65	553	50·4	1·984	34·2	923	139·4	717	157	637
15	35·2	841	35·9	786	33·4	2·994	66	518	51·0	962	34·5	901	140·2	713	161	621
16	35·6	809	35·9	784	33·6	976	68	489	51·5	941	34·7	882	141·0	709	166	602
17	36·0	778	35·9	782	33·9	949	69	453	52·1	920	35·0	857	141·8	705	170	585
18	36·4	747	35·9	780	34·2	924	71	416	52·7	898	35·2	841	142·6	701	175	571
19	36·8	717	36·0	778	34·4	903	72	380	53·3	876	35·5	817	143·4	697	180	556
20	37·2	688	36·0	776	34·7	882	74	350	53·9	855	35·7	801	144·2	693	185	541
21	37·6	660	36·0	774	35·0	857	75	325	54·5	835	36·0	778	145·1	689	190	526
22	38·0	632	36·0	772	35·3	833	77	299	55·1	815	36·2	762	145·9	685	195	513
23	38·4	604	36·1	770	35·5	813	79	272	55·7	795	36·5	740	146·7	682	200	500
24	38·8	577	36·1	768	35·8	793	80	250	56·3	776	36·7	724	147·5	678	205	488
25	39·3	545	36·1	766	36·1	771	82	224	56·9	757	37·0	703	148·3	674	210	476

26	39·7	519	36·1	764	36·4	747	84	202	57·5	739	37·2	688	149·1	671	216	463
27	40·1	494	36·2	762	36·6	732	87	179	58·1	721	37 5	667	149·9	667	221	451
28	40·5	469	36·2	759	36·9	710	89	147	58·7	703	37·7	652	150·7	664	226	441
29	40·9	445	36·2	757	37·2	688	91	112	59·3	686	38·0	632	151·5	660	232	432
30	41·4	415	36·3	754	37·4	673	93	077	60·0	668	38·2	618	152·3	657	238	422
31	41·8	392	36·3	752	37·7	660	96	042	60·6	650	38·5	599	153	654	244	410
32	42·2	370	36·3	749	38·0	633	98	010	61·3	632	38·7	583	154	650	250	400
33	42·7	342	36·4	747	38·2	617	100	0·990	61·9	616	39·0	564	155	646	256	390
34	43·1	320	36·4	744	38·5	598	103	971	62·5	600	39·2	552	156	642	262	381
35	43·6	294	36·4	742	38·7	584	104	953	63·2	583	39·5	532	156	639	268	372
36	44·0	273	36·5	740	39·0	565	105	942	63·9	565	39·7	514	157	636	274	365
37	44·4	252	36·5	737	39·3	546	107	935	64·6	548	40·0	500	158	633	280	357
38	44·9	227	36·5	731	39·6	526	108	926	65·3	531	40·2	487	159	629	286	350
39	45·3	205	36·6	732	39·9	506	109	917	66·0	515	40·5	469	160	626	292	342
40	45·8	183	36·6	729	40·1	492	110	909	66·7	499	40·7	455	160	623	298	336
41	46·2	164	36·6	727	40·3	481	111	901	67·4	483	41·0	439	161	621	304	329
42	46·7	141	36·7	725	40·6	465	112	892	68·2	467	41·3	424	162	618	311	322
43	47·1	123	36·7	721	40·9	446	113	885	68·9	451	41·6	410	163	615	317	315
44	47·6	102	36·8	717	41·2	427	114	877	69·7	435	41·9	396	164	612	324	309
45	48·0	083	36·8	714	41·5	410	115	870	70·4	420	42·2	376	164	610	331	302
46	48·5	062	36·8	712	41·7	394	116	862	71·2	404	42·5	356	165	607	337	296
47	49·0	041	36·9	710	42·0	380	117	855	72·0	389	42·7	341	166	602	344	291
48	49·5	020	36·9	707	42·3	364	118	847	72·8	374	43·0	326	167	600	351	285
49	49·9	004	36·9	705	42·5	350	119	840	73·6	359	43·3	309	168	597	358	280
50	50·4	1·984	37·0	703	42·8	336	120	833	74·4	344	43·6	294	168	595	365	274
51	50·9	966	37·0	700	43·1	320	121	826	75·3	328	43·9	278	169	592	372	269
52	51·3	949	37·0	698	43·4	304	122	819	76·1	314	44·2	262	170	588	379	264
53	51·8	931	37·1	695	43·6	297	123	813	77·0	299	44·4	246	171	585	387	260
54	52·3	912	37·1	693	43·9	278	124	806	77·9	284	44·7	230	172	583	395	255
55	52·8	894	37·1	690	44·2	262	125	800	78·7	270	45·0	223	172	580	402	251

TABLE LXXIId. 2—*continued.*

a. Weight of Compound dissolved in 100 grms of Water. *b.* Weight of Water required to dissolve 1 grm. of Compound.

t° C.	NH_4Cl.		NaCl.		KCl.		$CaCl_2$.		$SrCl_2$.		$BaCl_2$.		KI.		NH_4NO_3.	
	a	*b*	*a*	*b*	*a*	*b*	*a*	*b*	*a*	*b*	*a*	*b*	*a*	*b*	*a*	*b*
56°	53·2	1·878	37·2	2·688	44·4	2·253	126	0·794	79·6	1·256	45·3	2·207	173	0·578	410	0·247
57	53·7	862	37·2	685	44·7	236	127	787	80·4	242	45·6	193	174	576	418	243
58	54·2	845	37·2	683	44·9	227	128	781	81·3	230	45·9	179	175	574	425	239
59	54·7	828	37·3	681	45·2	212	129	777	82·2	217	46·2	165	175	571	433	235
60	55·2	812	37·3	678	45·5	198	129	772	83·1	203	46·4	153	176	568	441	231
61	55·7	795	37·3	676	45·8	184	130	768	84·0	190	46·7	141	177	565	449	226
62	56·2	779	37·4	673	46·1	169	131	763	84·9	178	47·0	128	178	562	457	222
63	56·7	764	37·4	670	46·3	157	131	760	85·8	166	47·3	114	179	559	465	218
64	57·2	748	37·5	667	46·6	146	132	756	86·6	155	47·6	101	180	557	473	214
65	57·7	733	37·5	663	46·9	132	133	753	87·5	143	47·9	088	180	554	481	210
66	58·2	718	37·6	659	47·2	119	133	750	88·4	131	48·2	075	181	552	490	206
67	58·7	704	37·7	654	47·5	105	134	746	88·9	124	48·5	062	182	550	499	202
68	59·2	689	37·7	650	47·7	094	135	743	89·1	122	48·8	049	183	548	508	198
69	59·7	675	37·8	646	48·0	083	135	740	89·3	120	49·1	037	184	546	517	194
70	60·2	661	37·9	642	48·3	070	136	737	89·6	117	49·4	024	184	543	526	190
71	60·7	647	37·9	638	48·5	060	136	734	89·8	114	49·7	012	185	541		
72	61·2	634	38·0	634	48·8	049	137	730	90·1	110	50·0	000	186	538		
73	61·7	621	38·0	630	49·1	037	138	727	90·3	107	50·3	1·988	187	536		
74	62·3	605	38·1	627	49·4	024	138	724	90·6	104	50·6	976	188	534		
75	62·8	591	38·2	624	49·6	014	139	721	90·9	100	50·9	965	188	531		
76	63·4	577	38·2	621	49·9	004	139	718	91·2	097	51·2	953	189	529		
77	63·9	564	38·2	617	50·2	1·993	140	714	91·5	093	51·5	941	190	526		
78	64·5	550	38 2	614	50·5	981	141	711	91·8	089	51·8	930	191	524		
79	65·1	536	38·3	611	50·8	969	141	709	92·1	086	52·1	919	192	522		
80	65·6	523	38·4	607	51·0	960	142	706	92·4	082	52·4	909	192	520		

81	66·2	511	38·4	602	51·3	949	142	704	92·7	079	52·7	898	193	518			
82	66·7	499	38·5	597	51·5	940	143	701	93·1	075	53·0	887	194	515			
83	67·3	486	38·6	593	51·8	931	143	698	93·4	071	53·3	876	195	513			
84	67·8	475	38·6	588	52·1	920	144	695	93·7	067	53·6	866	196	511			
85	68·4	462	38·7	583	52·4	909	144	693	94·1	063	54·0	855	197	509			
86	69·0	449	38·7	578	52·6	900	145	691	94·5	058	54·3	843	197	507			
87	69·6	437	38·8	574	52·9	890	145	688	94·9	054	54·6	832	198	505			
88	70 2	425	38·9	569	53·2	880	146	685	95·4	049	55·0	820	199	503			
89	70·7	414	39·0	564	53·5	869	147	682	95·8	044	55·3	808	200	500			
90	71·3	403	39·1	560	53·8	859	147	678	96·2	040	55·6	798	201	498			
91	71·9	391	39·1	555	54·1	848	148	675	96·7	035	55·9	789	202	496			
92	72·5	379	39·2	551	54·4	838	149	671	97·2	030	56·2	779	202	494			
93	73·1	368	39·3	547	54·6	829	150	668	97·7	024	56·6	769	203	492			
94	73·7	357	39·3	544	54·9	821	150	665	98·2	018	56·9	759	204	490			
95	74·3	346	39·4	540	55·2	812	151	661	98·8	012	57·2	748	205	488			
96	74·9	335	39·4	536	55·5	802	152	658	99·4	006	57·6	737	206	486			
97	75·5	325	39·5	532	55·7	794	152	655	100·0	000	57·9	727	207	484			
98	76·1	314	39·6	526	56·0	786	153	652	100·6	0·994	58·2	718	208	482			
99	76·7	304	39·7	519	56·3	777	154	649	101·3	987	58·5	709	208	480			
100	77·3	294	39·8	513	56·6	767			101·9	981	58·8	700	209	478			
179°·5							325										

TABLE LXXIId. 3.—**Solubilities of various Compounds at various Temperatures up to 100° C.**

a. Weight of Compound dissolved in 100 grms. of Water. *b.* Weight of Water required to dissolve 1 grm. of Compound.

t° C.	$NaNO_3$		KNO_3		$Sr(NO_3)_2$		$Ba(NO_3)_2$		$Pb(NO_3)_2$		$(NH_4)_2SO_4$		Na_2SO_4		K_2SO_4	
	a	*b*	*a*	*b*	*a*	*b*	*a*	*b*	*a*	*b*	*a*	*b*	*a*	*b*	*a*	*b*
0°	72·9	1·372	13·3	7·519	39·5	2·532	5·0	20·000	36·5	2·740	70·6	1·416	4·8	20·833	8·5	11·765
1	74·7	339	13·8	7·246	41·2	427	5·1	19·608	37·4	674	70·9	410	5·1	19·608	8·6	11·628
2	75·4	326	14·6	6·849	42·8	336	5·3	18·868	38·3	610	71·1	406	5·4	18·519	8·7	11·494
3	76·0	315	15·5	6·452	44·3	257	5·5	18·182	39·1	558	71·4	401	5·7	17·544	8·8	11·360
4	76·7	304	16·4	6·098	45·8	183	5·7	17·544	39·8	513	71·6	397	6·0	16·667	9·0	11·111
5	77·4	292	17·1	5·848	47·3	114	6·0	16·667	40·5	469	71·8	393	6·4	15·625	9·1	10·989
6	78·1	280	17·8	5·618	48·8	049	6·2	16·129	41·2	427	72·1	388	6·8	14·706	9·2	10·870
7	78·7	270	18·5	5·405	50·3	1·988	6·4	15·625	42·0	381	72·3	383	7·3	13·699	9·3	10·753
8	79·4	260	19·3	5·181	51·8	931	6·6	15·152	42·8	336	72·5	379	7·8	12·821	9·4	10·638
9	80·1	249	20·2	4·950	53·4	873	6·8	14·706	43·6	294	72·8	374	8·4	11·905	9·5	10·523
10	80·8	238	21·1	4·739	54·9	821	7·0	14·286	44·4	252	73·0	370	9·0	11·111	9·7	10·323
11	81·4	228	22·0	4·545	56·5	770	7·3	13·699	45·2	212	73·2	366	9·7	10·309	9·8	10·204
12	82·0	219	23·0	4·348	58·0	724	7·5	13·333	46·0	174	73·5	361	10·5	9·524	9·9	10·100
13	82·7	209	24·0	4·167	59·6	678	7·7	12·987	46·8	137	73·7	357	11·4	8·772	10·0	10·000
14	83·4	199	25·0	4·000	61·2	634	7·9	12·658	47·5	105	74·0	351	12·4	8·065	10·2	9·804
15	84·0	190	26·0	3·846	62·8	592	8·1	12·346	48·3	070	74·2	348	13·4	7·463	10·3	9·709
16	84·7	180	27·0	704	64·4	553	8·3	12·048	49·1	037	74·4	344	14·5	6·897	10·4	9·615
17	85·4	171	28·1	559	66·0	515	8·5	11·765	49·9	004	74·7	339	15·7	6·369	10·5	9·524
18	86·1	161	29·1	436	67·6	479	8·8	11·364	50·7	1·972	74·9	335	16·9	5·917	10·7	9·400
19	86·8	152	30·2	311	69·2	445	9·0	11·111	51·5	942	75·1	331	18·2	5·495	10·8	9·260
20	87·5	143	31·2	205	70·8	412	9·2	10·869	52·3	912	75·4	326	19·5	5·128	10·9	9·174
21	88·3	133	32·3	096	72·5	379	9·5	10·526	53·1	883	75·7	321	20·9	4·785	11·1	9·001
22	89·0	124	33·5	2·985	74·1	350	9·7	10·309	53·9	855	75·9	317	22·5	4·444	11·2	8·929
23	89·7	115	34·7	882	75·8	319	9·9	10·101	54·7	828	76·2	312	24·1	4·149	11·3	8·850
24	90·3	107	36·0	778	77·4	292	10·1	9·901	55·6	799	76·4	308	25·9	3·861	11·5	8·700
25	91·0	099	37·3	681	79·0	266	10·4	9·615	56·4	773	76·7	304	27·9	3·584	11·6	8·620

26	91·8	089	38·6	591	80·7	239	10·6	9·434	57·3	745	76·9	300	30·1	3·322	11·7	8·547
27	92·5	081	40·0	500	82·4	214	10·8	9·259	58·1	721	77·2	295	32·4	3·086	11·9	8·403
28	93·2	073	41·4	415	84·1	189	11·1	9·009	59·0	695	77·5	290	35·0	2·857	12·0	8·333
29	94·0	064	42·9	331	85·8	166	11·3	8·850	59·8	672	77·8	285	37·8	2·646	12·2	8·200
30	94·9	054	44·5	247	87·6	142	11·6	8·621	60·7	647	78·0	281	40·9	2·445	12·3	8·130
31	96·0	047	46	174	89·5	117	11·8	8·475	61·6	623	78·3	277	44·2	2·262	12·5	8·000
32	96	041	48	084	90·2	108	12·1	8·264	62·4	602	78·6	272	47·8	2·092	12·6	7·937
33	97	032	50	000	90·3	107	12·3	8·130	63·3	580	78·9	267	50·6	1·976	12·8	7·812
34	98	022	52	1·923	90·5	105	12·6	7·937	64·1	560	79·2	263	50·4	1·984	13·0	7·692
35	99	013	54	852	90·6	104	12·8	7·813	65·0	539	79·5	258	50·2	1·992	13·1	7·604
36	100	004	56	786	90·7	103	13·1	7·634	65·9	518	79·8	253	49·9	2·004	13·3	7·518
37	100	0·995	58	724	90·8	101	13·4	7·463	66·7	499	80·1	248	49·6	016	13·4	7·435
38	101	989	60	667	91·0	099	13·7	7·299	67·6	479	80·4	244	49·3	028	13·6	7·353
39	102	982	62	613	91·1	098	14·0	7·143	68·5	460	80·7	239	49·1	037	13·8	7·246
40	102	977	64	563	91·3	095	14·2	7·042	69·4	441	81·0	235	48·8	049	14·0	7·143
41	103	971	66	515	91·4	094	14·5	6·897	70·3	422	81·3	230	48·5	062	14·2	7·042
42	104	962	68	471	91·5	093	14·8	6·757	71·2	404	81·7	225	48·3	070	14·3	6·993
43	105	952	70	429	91·6	092	15·1	6·623	72·1	387	82·0	220	48·1	079	14·5	6·897
44	106	943	72	389	91·8	090	15·4	6·494	73·0	370	82·3	215	47·9	088	14·7	6·803
45	107	935	74	351	91·9	088	15·6	6·410	74·0	351	82·7	210	47·7	096	14·9	6·711
46	108	926	76	316	92·1	086	15·9	6·289	74·9	335	83·0	205	47·5	105	15·1	6·623
47	109	917	78	282	92·2	085	16·2	6·173	75·9	318	83·3	200	47·3	114	15·3	6·536
48	110	909	81	243	92·3	083	16·5	6·061	76·8	302	83·7	195	47·1	123	15·5	6·452
49	111	901	83	205	92·5	081	16·8	5·952	77·7	287	84·0	190	46·9	132	15·6	6·390
50	112	893	86	163	92·6	080	17·1	5·848	78·7	271	84·4	185	46·7	141	15·8	6·329
51	113	885	88	136	92·8	078	17·4	5·747	79·6	256	84·7	180	46·6	146	16·0	6·250
52	114	877	91	099	92·9	076	17·7	649	80·5	242	85·1	175	46·4	155	16·2	6·173
53	115	869	93	070	93·1	074	18·1	537	81·5	227	85·5	170	46·2	164	16·4	6·098
54	116	862	96	042	93·2	072	18·4	435	82·4	213	85·8	165	46·1	172	16·6	6·024
55	117	855	98	020	93·4	070	18·7	347	83·3	200	86·2	160	45·9	179	16·8	5·952

TABLE LXXIID. 3—*continued.*

a. Weight of Compound dissolved in 100 grms. of Water. *b.* Weight of Water required to dissolve 1 grm. of Compound.

t° C.	$NaNO_3$.		KNO_3.		$Sr(NO_3)_2$.		$Ba(NO_3)_2$.		$Pb(NO_3)_2$.		$(NH_4)_2SO_4$.		Na_2SO_4.		K_2SO_4.	
	a	*b*	*a*	*b*	*a*	*b*	*a*	*b*	*a*	*b*	*a*	*b*	*a*	*b*	*a*	*b*
56°	118	0·847	101	0·991	93·5	1·069	19·0	5·263	84·3	1·186	86·6	1·155	45·8	2·184	17·0	5·882
57	119	840	103	971	93·6	068	19·3	181	85·2	173	86·9	150	45·7	188	17·2	814
58	120	833	106	948	93·8	066	19·6	102	86·1	161	87·3	145	45·6	193	17·4	747
59	121	825	108	926	93·9	065	20·0	000	87·1	148	87·7	140	45·4	198	17·6	682
60	122	817	111	901	94·0	064	20·3	4·926	88·0	136	88·0	135	45·3	205	17·8	618
61	124	809	113	880	94·2	062	20·6	854	89·0	124	88·4	131	45·2	212	18·0	556
62	125	801	116	860	94·3	060	20·9	785	90·0	111	88·7	127	45·1	217	18·2	495
63	126	793	119	840	94·5	058	21·2	717	90·9	100	89·1	122	45·0	222	18·4	435
64	127	785	121	823	94·6	057	21·6	630	91·9	088	89·5	117	44·9	227	18·6	376
65	128	777	124	806	94·8	055	21·9	566	92·8	077	89·9	112	44·8	231	18·8	319
66	130	769	127	788	94·9	054	22·3	484	93·8	066	90·2	108	44·7	235	19·0	263
67	131	762	130	769	95·1	052	22·6	425	94·8	055	90·6	104	44·6	239	19·2	208
68	132	756	133	752	95·2	050	22·9	367	95·7	045	90·9	100	44·5	243	19·4	155
69	133	750	136	735	95·4	048	23·3	292	96·7	034	91·3	095	44·5	247	19·6	102
70	134	743	139	719	95·6	046	23·6	237	97·7	024	91·6	091	44·4	251	19·8	051
71	136	737	142	704	95·7	045	23·9	184	98·7	013	92·0	087	44·3	255	20·0	000
72	137	731	146	687	95·9	043	24·4	098	99·7	003	92·4	082	44·2	259	20·2	4·950
73	138	725	149	671	96·0	042	24·7	049	100·7	0·993	92·7	078	44·2	263	20·4	902
74	139	718	152	657	96·2	040	25·0	000	101·7	983	93·1	074	44·1	267	20·6	854
75	140	712	155	645	96·4	038	25·4	3·941	102·6	974	93·4	070	44·0	271	20·8	808
76	142	705	159	630	96·5	036	25·7	892	103·6	965	93·8	066	44·0	275	21·0	762
77	143	698	162	616	96·7	034	26·0	846	104·6	956	94·2	062	43·9	279	21·2	717
78	145	691	165	602	96·8	033	26·4	798	105·6	947	94·5	058	43·8	282	21·4	673
79	146	684	168	596	97·0	031	26·7	750	106·6	938	94·9	054	43·7	285	21·6	630
80	148	677	172	581	97·2	029	27·0	703	107·6	929	95·3	050	43·7	289	21·8	587

81	149	669	175	569	97·4	027	27·4	649	108·6	921	95·6	046	43·6	292	22·0	545
82	151	662	179	558	97·5	026	27·7	601	109·6	912	96·0	042	43·5	295	22·2	504
83	152	656	182	549	97·7	024	28·1	558	110·6	904	96·4	038	43·5	299	22·4	464
84	153	650	185	540	97·9	022	28·4	514	111·5	896	96·8	034	43·4	302	22·6	425
85	155	644	189	530	98·0	020	28·8	472	112·5	889	97·2	030	43·3	306	22·8	386
86	156	638	192	521	98·2	018	29·1	430	113·5	881	97·6	026	43·3	309	23·0	348
87	158	632	196	512	98·4	016	29·5	389	114·5	873	98·0	022	43·2	312	23·2	310
88	159	626	199	503	98·6	014	29·8	350	115·4	866	98·4	017	43·2	315	23·4	273
89	161	620	203	494	98·8	012	30·2	311	116·4	859	98·8	012	43·1	318	23·6	237
90	162	614	206	485	99·0	010	30·6	272	117·4	852	99·2	008	43·1	321	23·9	200
91	164	608	210	476	99·2	008	30·9	236	118·4	845	99·6	004	43·0	324	24·1	160
92	166	602	214	467	99·4	006	31·3	198	119·4	838	100·0	000	43·0	327	24·3	120
93	168	596	218	458	99·6	004	31·7	162	120·3	831	100·4	0·996	42·9	330	24·5	081
94	169	590	222	450	99·8	002	32·0	125	121·3	824	100·8	992	42·9	333	24·7	040
95	171	584	226	442	100·0	000	32·4	088	122·3	817	101·2	988	42·8	336	25·0	000
96	173	579	230	435	100·2	0·998	32·7	052	123·2	811	101·6	984	42·7	339	25·2	3·960
97	175	573	234	429	100·4	996	33·1	018	124·2	805	102·1	980	42·6	342	25·5	921
98	177	568	238	421	100·6	994	33·5	2·985	125·2	799	102·5	976	42·6	345	25·7	885
99	178	562	243	412	100·9	991	33·8	952	126·1	793	102·9	972	42·5	348	25·9	851
100	180	556	247	404	101·1	989	34·2	918	127·0	787	103·3	968	42·5	351	26·2	817
101							34·5	899								
101°·9							34·8	874								

TABLE LXXIID. 4.—**Solubilities of various Compounds at various Temperatures up to 100° C.**

a. Weight of Compound dissolved in 100 grms. of Water. *b.* Weight of Water required to dissolve 1 grm. of Compound.

t° C.	$MgSO_4$.		$MnSO_4$.		$FeSO_4$.		$NiSO_4$.		$CoSO_4$.		$CuSO_4$.		$ZnSO_4$.		Na_2CO_3.	
	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b
0°	26·9	3·717	55·4	1·805	7·9	12·658	29·3	3·413	24·6	4·065	15·5	6·452	44·0	2·273	7·1	14·085
1	27·4	650	55·9	789	8·7	11·494	29·7	367	25·0	4·000	16·3	135	44·6	242	7·5	13·333
2	27·9	584	56·5	773	9·5	10·526	30·1	322	25·5	3·922	16·6	024	45·2	212	7·8	12·821
3	28·3	534	57·1	751	10·4	9·615	30·5	278	26·0	846	16·9	5·917	45·8	183	8·4	11·905
4	28·8	472	57·7	731	11·2	8·929	31·0	225	26·5	774	17·2	814	46·4	155	8·9	11·236
5	29·3	413	58·2	711	12·0	8·333	31·5	175	27·0	704	17·5	715	47·0	127	9·5	10·526
6	29·7	367	58·8	696	12·9	7·752	32·0	125	27·5	636	17·8	618	47·6	100	10·0	10·000
7	30·2	311	59·4	681	13·7	7·299	32·5	077	28·0	571	18·1	525	48·3	073	10·6	9·434
8	30·6	268	60·0	667	14·5	6·897	33·0	030	28·5	509	18·4	435	48·9	046	11·2	8·929
9	31·1	215	60·5	653	15·3	6·536	33·5	2·985	29·0	448	18·7	348	49·5	020	11·9	8·403
10	31·5	175	61·1	638	16·2	6·173	34·0	941	29·5	390	19·1	263	50·2	1·994	12·6	7·937
11	32·0	135	61·7	621	17·0	5·882	34·5	899	30·0	333	19·3	181	50·8	969	13·3	7·519
12	32·4	089	62·2	606	17·9	5·587	35·0	857	30·5	279	19·6	102	51·5	943	14·0	7·143
13	32·9	049	62·7	594	18·7	5·348	35·5	817	31·0	226	19·9	025	52·2	917	14·8	6·757
14	33·4	2·999	63·3	580	19·5	5·128	36·0	778	31·5	175	20·2	4·950	52·8	892	15·6	6·410
15	33·8	959	63·8	567	20·4	4·902	36·5	740	32·0	125	20·5	878	53·5	868	16·5	6·061
16	34·3	916	64·3	555	21·2	717	37·0	703	32·5	077	20·8	808	54·2	845	17·4	5·747
17	34·7	880	64·8	543	22·1	525	37·5	667	33·0	030	21·1	739	54·9	822	18·3	5·464
18	35·2	841	65·3	531	23·0	347	38·0	632	33·5	2·985	21·4	673	55·6	799	19·3	5·181
19	35·7	801	65·8	520	23·8	202	38·5	597	34·0	941	21·7	609	56·3	776	20·3	4·926
20	36·2	762	66·3	508	24·7	048	39·0	564	34·5	897	22·0	545	57·0	754	21·4	4·673
21	36·7	745	66·7	498	25·6	3·906	39·5	532	35·1	849	22·3	484	57·7	733	22·6	4·425
22	37·1	697	67·2	488	26·4	788	40·0	500	35·6	809	22·6	425	58·4	712	23·8	4·202
23	37·6	659	67·6	479	27·3	663	40·5	469	36·2	762	23·0	366	59·2	691	25·1	3·984
24	38·0	622	68·1	469	28·1	558	41·0	439	36·8	717	23·3	293	59·9	670	26·5	3·774
25	38·5	590	68·5	459	29·0	448	41·5	410	37·4	674	23·7	219	60·7	649	28·0	3·572

26	39·0	560	68·9	450	29·9	344	42·0	381	38·0	632	24·0	158	61·4	629	29·7	367
27	39·5	531	69·3	442	30·8	247	42·5	353	38·5	598	24·4	098	62·1	610	31·6	165
28	39·9	503	69·7	434	31·7	154	43·0	326	39·1	557	24·7	041	62·8	592	33·6	2·976
29	40·4	475	70·0	427	32·6	067	43·5	299	39·6	523	25·1	3·984	63·6	574	35·8	793
30	40·9	447	70·4	420	33·5	2·985	44·0	273	40·2	489	25·5	922	64·3	556	38·1	625
31	41·4	418	70·7	414	34·4	906	44·5	247	40·7	455	25·9	861	65·1	538	41·4	415
32	41·8	390	71·0	408	35·3	833	45·0	222	41·3	421	26·3	801	65·8	520	46·2	166
33	42·3	363	71·3	402	36·2	762	45·5	198	41·8	389	26·7	745	66·6	502	46·2	166
34	42·8	336	71·6	397	37·1	695	46·0	174	42·4	358	27·1	690	67·3	485	46·2	165
35	43·3	309	71·9	391	38·0	631	46·5	151	42·9	328	27·5	636	68·1	468	46·2	165
36	43·7	282	72·2	385	38·9	571	47·0	128	43·5	299	27·9	585	68·8	452	46·2	165
37	44·2	258	72·4	380	39·8	513	47·5	105	44·0	270	28·3	534	69·6	437	46·2	165
38	44·7	234	72·7	375	40·7	455	48·0	083	44·6	242	28·7	484	70·4	422	46·2	165
39	45·2	210	72·9	371	41·7	398	48·5	062	45·2	207	29·1	436	71·2	405	46·2	165
40	45·6	195	73·1	368	42·6	345	49·0	040	45·8	183	29·5	389	Decomposed above 40°.		46·2	165
41	46·1	169	73·3	364	43·5	298	49·6	018	46·4	156	29·9	344			46·2	165
42	46·5	150	73·5	361	44·4	252	50·1	1·996	47·0	129	30·3	300			46·2	165
43	47·0	129	73·7	357	45·3	208	50·6	976	47·6	102	30·7	257			46·2	165
44	47·5	107	73·9	353	46·2	164	51·2	955	48·2	075	31·1	215			46·2	165
45	48·0	085	74·0	350	47·1	122	51·7	934	48·8	049	31·5	175			46·2	165
46	48·4	065	74·2	347	48·1	080	52·3	913	49·4	024	31·9	135			46·2	165
47	48·9	045	74·4	344	49·0	040	52·8	893	50·0	000	32·3	096			46·2	165
48	49·3	026	74·6	341	50·0	000	53·4	873	50·6	1·976	32·7	058			46·2	165
49	49·8	008	74·7	339	51·0	1·961	53·9	854	51·2	953	33·2	020			46·2	165
50	50·3	1·989	74·8	337	51·9	925	54·5	835	51·8	930	33·6	2·976			46·2	165
51	50·7	972	74·9	335	52·9	890	55·0	817	52·4	908	34·1	932			46·2	165
52	51·2	954	75·1	332	53·8	857	55·6	799	53·0	886	34·5	899			46·2	165
53	51·7	935	75·2	330	54·8	824	56·1	782	53·6	865	35·0	857			46·2	165
54	52·2	916	75·3	328	55·7	792	56·7	765	54·2	845	35·5	817			46·2	165
55	52·7	897	74·7	339	56·7	762	57·3	749	54·8	825	36·0	778			46·2	165

TABLE LXXIID. 4—*continued*.

a. Weight of Compound dissolved in 100 grms. of Water. *b.* Weight of Water required to dissolve 1 grm. of Compound.

$t°$ C.	$MgSO_4$.		$MnSO_4$.		$FeSO_4$.		$NiSO_4$.		$CoSO_4$.		$CuSO_4$.		$ZnSO_4$.		Na_2CO_3.	
	a	*b*	*a*	*b*	*a*	*b*	*a*	*b*	*a*	*b*	*a*	*b*	*a*	*b*	*a*	*b*
56°	53·2	1·879	74·0	1·351	57·7	1·733	57·9	1·733	55·4	1·805	36·6	2·732			46·2	2·165
57	53·6	864	72·9	372	58·7	704	58·4	716	56·0	786	37·2	688			46·2	165
58	54·1	849	71·5	399	59·7	675	59·0	698	56·6	767	37·8	646			46·2	165
59	54·5	835	69·5	439	60·7	647	59·6	680	57·2	748	38·4	604			46·2	165
60	55·0	819	65·9	517	61·7	620	60·2	662	57·8	730	39·0	564			46·2	165
61	55·5	802			62·7	595	60·7	646	58·4	712	39·6	525			46·2	165
62	55·9	788			63·7	570	61·3	631	59·0	694	40·2	487			46·2	165
63	56·4	773			64·8	545	61·9	616	59·6	677	40·9	449			46·2	165
64	56·8	760	61·5	625	65·4	529	62·4	602	60·2	661	41·5	411			46·2	166
65	37·3	746	61·5	625	65·3	531	63·0	588	60·8	645	42·2	373			46·2	166
66	57·7	733	61·5	626	65·2	534	63·6	574	61·4	629	42·9	335			46·2	166
67	58·2	719	61·5	626	65·1	536	64·1	560	62·0	613	43·6	397			46·2	166
68	58·6	705	61·5	626	65·0	538	64·7	546	62·6	597	44·3	359			46·2	166
69	59·1	692	61·5	626	64·9	541	65·3	532	63·2	582	45·0	222			46·2	166
70	59·6	679	61·5	626	64·8	543	65·9	518	63·8	567	45·7	185			46·2	167
71	60·0	666	61·5	626	64·7	546	66·5	504	64·4	553	46·4	150			46·2	167
72	60·5	653	61·5	626	64·5	550	67·0	491	65·0	539	47·2	116			46·2	167
73	61·0	640	61·5	626	64·4	553	67·6	479	65·6	525	47·9	084			46·2	167
74	61·4	628	61·5	626	64·2	557	68·2	467	66·2	511	48·7	053			46·2	167
75	61·9	616	61·5	626	64·0	563	68·8	455	66·8	497	49·5	022			46·2	167
76	62·3	605	61·5	626	63·7	570	69·3	443	67·4	484	50·3	1·991			46·2	168
77	62·8	594	61·5	626	63·4	578	69·9	431	68·0	471	51·1	961			46·2	168
78	63·2	583	61·5	627	63·1	585	70·5	419	68·6	458	51·9	931			46·2	168
79	63·7	571	61·5	627	62·7	595	71·1	407	69·2	445	52·7	900			46·2	168
80	64·2	559	61·5	627	62·3	605	71·7	395	69·8	433	53·5	869			46·1	168

81	64·6	548	61·5	627	61·9	616	72·3	383	70·4	421	54·3	839			46·1	169
82	65·1	537	61·5	627	61·5	627	72·9	371	71·0	409	55·1	809			46·1	170
83	65·6	526	61·5	628	61·0	639	73·5	360	71·6	397	55·9	779			46·0	172
84	66·0	515	61·4	629	60·4	655	74·1	349	72·2	385	56·8	750			46·0	174
85	66·5	504	61·3	631	59·8	672	74·6	339	72·8	374	57·8	721			45·9	176
86	67·0	493	61·2	634	59·2	689	75·2	329	73·4	363	58·7	700			45·9	178
87	67·5	482	61·0	639	58·5	709	75·8	319	74·0	352	59·7	679			45·8	180
88	68·0	471	60·8	645	57·7	732	76·4	309	74·6	341	60·7	658			45·8	182
89	68·4	461	60·6	650	57·0	755	77·0	299	75·2	330	61·7	637			45·8	184
90	68·9	451	60·3	658	56·2	779	77·6	289	75·9	319	62·7	612			45·7	186
91	69·4	441	60·0	667	55·3	808	78·2	279	76·6	308	63·7	584			45·7	188
92	69·9	431	59·6	678	54·3	842	78·8	269	77·2	297	64·8	554			45·7	189
93	70·4	421	59·2	689	53·3	876	79·4	259	77·9	285	65·8	530			45·6	191
94	70·9	411	58·6	706	52·2	916	80·1	249	78·6	274	66·9	495			45·6	193
95	71·4	401	57·9	727	51·0	961	80·7	239	79·2	263	68·0	460			45·6	194
96	71·9	391	57·2	748	49·6	2·016	81·3	230	79·9	252	69·1	447			45·6	195
97	72·4	381	56·3	776	48·0	083	81·9	221	80·6	241	70·2	424			45·5	196
98	72·8	372	55·4	805	46·3	160	82·5	212	81·3	230	71·3	402			45·5	198
99	73·3	364	54·3	842	44·5	247	83·1	203	81·9	220	72·4	380			45·5	200
100	73·8	355	52·9	890	42·6	347	83·7	194	82·6	211	73·5	360			45·4	202

TABLE LXXIID. 5.—**Solubilities of various Compounds at various Temperatures up to 100° C.**

a. Weight of Compound dissolved in 100 grms of Water. *b.* Weight of Water required to dissolve 1 grm. of Compound.

t° C.	$NaHCO_3$.		K_2CO_3.		Na_2HPO_4.											
	a	*b*	*a*	*b*	*a*	*b*	*a*	*b*	*a*	*b*	*a*	*b*	*a*	*b*	*a*	*b*
0°	6·90	14·493	89·4	1·119	2·5	40·000										
1	7·00	14·286	94	1·064	2·6	38·778										
2	7·10	14·084	97	1·031	2·6	37·601										
3	7·20	13·889	100	1·000	2·7	36·468										
4	7·35	13·605	102	0·980	2·7	35·379										
5	7·45	13·382	104	961	2·8	34·334										
6	7·60	13·158	105	953	3·0	33·333										
7	7·70	12·938	106	944	3·2	31·250										
8	7·85	12·719	107	935	3·4	29·412										
9	8·00	12·500	108	926	3·6	27·778										
10	8·15	12·300	109	921	3·9	25·641										
11	8·25	12·101	109	917	4·2	23·809										
12	8·40	11·903	109	912	4·5	22·222										
13	8·55	11·705	110	906	4·9	20·408										
14	8·70	11·507	110	901	5·3	18·868										
15	8·85	11·309	110	897	5·8	17·241										
16	9·00	11·111	111	893	6·3	15·873										
17	9·15	10·920	111	890	6·9	14·493										
18	9·30	10·750	111	887	7·6	13·158										
19	9·40	10·640	111	884	8·4	11·905										
20	9·60	10·417	112	882	9·3	10·752										
21	9·75	10·256	112	880	10·3	9·709										
22	9·90	10·101	112	878	11·4	8·772										
23	10·05	9·951	112	876	12·6	7·937										
24	10·20	804	112	875	14·0	7·143										
25	10·35	662	113	874	15·4	6·494										

26	10·50	524	113	873	16·9	5·917
27	10·65	389	113	872	18·5	5·405
28	10·80	259	113	871	20·2	4·950
29	10·95	132	114	870	22·0	4·545
30	11·10	009	114	869	24·1	4·149
31	11·25	8·889	114	868	26·4	3·788
32	11·40	772	114	867	29·1	3·436
33	11·55	658	115	866	32·1	3·115
34	11·70	547	115	865	35·5	2·817
35	11·90	410	115	864	39·3	2·544
36	12·05	299	115	863	43·6	2·294
37	12·20	197	116	862	49·5	2·020
38	12·35	097	116	861	55·5	1·802
39	12·50	000	116	860	60·6	650
40	12·70	7·874	117	857	63·9	565
41	12·90	752	117	854	66·2	511
42	13·05	663	117	850	68·6	458
43	13·20	576	118	847	70·8	412
44	13·40	463	118	843	72·9	372
45	13·55	380	119	840	74·8	337
46	13·75	273	119	836	76·5	307
47	13·90	194	120	833	78·2	279
48	14·10	092	120	830	79·7	255
49	14·30	6·993	121	826	81·2	232
50	14·45	920	121	823	82·5	212
51	14·65	826	122	820	83·7	194
52	14·85	734	122	816	84·8	179
53	15·00	667	123	813	85·8	166
54	15·20	579	124	809	86·7	153
55	15·40	494	124	806	87·7	140

TABLE LXXIId. 5—*continued.*

a. Weight of Compound dissolved in 100 grms. of Water. *b.* Weight of Water required to dissolve 1 grm. of Compound.

$t°$ C.	$NaHCO_3$.		K_2CO_3.		Na_2HPO_4.											
	a	*b*	*a*	*b*	*a*	*b*	*a*	*b*	*a*	*b*	*a*	*b*	*a*	*b*	*a*	*b*
56°	15·60	6·410	125	0·803	88·6	1·128										
57	15·80	329	125	800	89·4	117										
58	16·00	250	126	796	90·2	107										
59	16·20	173	127	791	90·9	100										
60	16·40	098	127	787	91·6	092										
61			128	784	92·2	084										
62			128	781	92·7	077										
63			129	777	93·1	071										
64			130	773	93·5	068										
65			130	769	93·8	064										
66			131	765	94·1	062										
67			132	761	94·4	060										
68			132	758	94·6	058										
69			133	754	94·8	056										
70			133	750	95·0	054										
71			134	746	95·1	052										
72			135	742	95·2	050										
73			135	738	95·4	048										
74			136	735	95·6	046										
75			137	731	95·8	044										
76			137	728	96·0	0·042										
77			138	724	96·1	040										
78			139	721	96·3	038										
79			139	718	96·5	036										
80			140	714	96·6	035										

81			141	711	96·8	033										
82			141	707	96·9	032										
83			142	704	97·0	031										
84			143	701	97·1	030										
85			144	698	97·2	029										
86			144	695	97·4	027										
87			145	691	97·5	026										
88			146	687	97·6	025										
89			147	684	97·7	024										
90			147	680	97·8	022										
91			148	676	97·9	021										
92			149	673	98·0	020										
93			150	669	98·1	019										
94			151	665	98·2	018										
95			151	662	98·4	016										
96			152	658	98·5	015										
97			153	654	98·6	014										
98			154	650	98·7	013										
99			155	645	98·8	012										
100			156	641												

TABLE LXXIID. 6.—**Solubilities of various Compounds at various Temperatures above 100° C.**

a. Weight of Compound dissolved in 100 grms. of Water. *b.* Weight of Water required to dissolve 1 grm. of Compound.

t° C.	NH_4Cl		NaCl.		KCl.		$SrCl_2$.		$BaCl_2$.		KI.		$NaNO_3$.		KNO_3.	
	a	*b*	*a*	*b*	*a*	*b*	*a*	*b*	*a*	*b*	*a*	*b*	*a*	*b*	*a*	*b*
101°	78·0	1·282	39·8	2·513	56·9	1·757	102·6	0·975	59·2	1·689	210	0·476	182	0·549	252	0·397
102	78·6	272	39·9	506	57·2	748	103·3	968	59·5	681	211	474	184	543	256	391
103	79·2	262	40·0	502	57·4	740	104·0	962	59·8	672	212	472	186	538	261	384
104	79·9	252	40·0	498	57·7	733	104·7	955	60·2	662	213	470	188	532	266	376
105	80·5	242	40·1	494	58·0	726	105·4	949			213	468	190	526	272	368
106	81·2	232	40·1	490	58·2	718	106·1	942			214	467	192	521	278	360
107	81·8	222	40·2	486	58·5	710	106·9	935			215	465	194	515	284	352
108	82·5	212	40·3	483			107·6	929			216	463	196	510	289	345
109	83·1	202	40·3	480			108·4	923			217	461	198	505	295	339
110	83·8	193					109·1	917			218	459	200	500	301	332
111	84·4	184					109·9	910			219	457	202	495	307	326
112	85·1	175					110·7	903			220	455	204	490	313	319
113	85·7	166					111·4	897			220	454	207	484	319	313
114	86·4	157					112·2	891			221	452	209	478	326	307
115	87·1	148					113·0	885			222	450	211	473		
116							113·8	879			223	448	213	469		
117							114·5	873					215	465		
118							115·5	866								
Max. Sol.	87·3 at 115°·65		40·4 at 109°·7		58·5 at 107°·65		116·4 at 118°·8		60·3 at 104°·1		223·6 at 117°		216·4 at 117°·5		327·4 at 114°·1	

TABLE LXXIID. 6—*continued.*

a. Weight of Compound dissolved in 100 grms. of Water. *b.* Weight of Water required to dissolve 1 grm. of Compound.

$t°$ C.	$Sr(NO_3)_2$.		$Pb(NO_3)_2$.		$(NH_4)_2SO_4$.		Na_2SO_4.		K_2SO_4.		$MgSO_4$.		$MnSO_4$.		$NiSO_4$.	
	a	*b*	*a*	*b*	*a*	*b*	*a*	*b*	*a*	*b*	*a*	*b*	*a*	*b*	*a*	*b*
101°	101·3	0·987	128·0	0·781	103·8	0·963	42·4	2·358	26·4	3·788	74·3	1·346	51·2	1·953	84·3	1·186
102	101·6	984	128·9	775	104·2	960	42·3	364	26·6	3·759	74·8	337	49·3	2·028	84·9	178
103	101·8	982	129·9	769	104·6	956	42·2	370			75·2	329	47·4 at 102°·5		85·6	169
104	102·0	980	130·9	764	105·1	952					75·7	321			86·2	160
105	102·3	978			105·5	948					76·2	312			86·8	152
106	102·5	975			106·0	943					76·7	304			87·5	143
107	102·7	973			106·5	939					77·2	295			88·1	135
108					107·0	935					77·7	287			88·7	127
109																
110																
111																
112																
113																
114																
115																
116																
117																
118																
Max. Sol.	102·9 at 107°·9		131·5 at 104°·7		107·5 at 108°·9				26·75 at 102°·25		77·9 at 108°·4				88·9 at 108°·4	

TABLE LXXIID. 6—*continued.*

a. Weight of Compound dissolved in 100 grms. of Water. *b.* Weight of Water required to dissolve 1 grm. of Compound.

t° C.	$CoSO_4$.		$CuSO_4$.		Na_2CO_3.		K_2CO_3.		Na_2HPO_4.	
	a	*b*	*a*	*b*	*a*	*b*	*a*	*b*	*a*	*b*
101°	83·3	1·200	74·6	1·340	45·4	2·203	157	0·637		
102	83·9	192	75·7	321	45·3	206	158	633		
103	84·6	183	76·8	302	45·3	208	159	629		
104	85·3	173			45·2	212	160	625		
105	86·0	163			45·1	217	161	621	82·5	
106	86·7	153					162	617		
107							163	613		
108							164	610		
109							166	605		
110							167	600		
111							168	595		
112							169	590		
113							171	585		
114							172	581		
115							173	578		
116							175	573		
117							176	568		
118							178	563		
119							179	558		
120							181	553		
121							182	548		
122							184	543		

123							185	538		
124							187	534		
125							188	530		
126							190	526		
127							191	522		
128							193	518		
129							195	513		
130							196	509		
131							198	505		
132							200	500		
133							201	496		
134							203	492		
135							205	488		
136										
Max. Sol.	86·9 at 106°·4		77·95 at 104°							

TABLE LXXIID.—*continued.*

7. Solubility of $Na_4C_3O_8$ (from $Na_4H_2(CO_3)_3 + 2H_2O$). (Poggiale.)

$t°$ C.	1 litre aq. dissolves.	$t°$ C.	1 litre aq. dissolves.	$t°$ C.	1 litre aq. dissolves.
0°	126·3	40°	239·5	80°	358·0
10	155·0	50	267·8	90	386·3
20	183·0	60	296·8	100	415·9
30	211·5	70	325·5		

8. Solubility of CrO_3. (Zettnow.)

$t°$ C.	Specific Gravity.	Percentage of CrO_3.	$t°$ C.	Specific Gravity.	Percentage of CrO_3.	$t°$ C.	Specific Gravity.	Percentage of CrO_3.
16°	1·0606	8·25	20°·1	1·20264	31·83	22°	1·3441	37·77
18	0679	8·79	12 ·0	20714	31·83	19 ·2	3448	37·82
14 ·5	0694	8·79	35 ·0	20940	32·59	22	34416	37·82
19 ·5	0957	12·34	18 ·6	21914	32·59		7028	62·23
19	1569	19·33	15 ·2	22106	32·59			
20 ·9	20269	31·83	9 ·7	22384	32·59			

9. Solubility of Thorium Sulphate.

100 parts of water at $t°$ dissolve from $Th(SO_4)_2 + 9H_2O$—
(Demareay and Roozeboom.)

$t°$ C.	0°	10°	20°	30°	40°	50°	55°	
Parts $Th(SO_4)_2$, .	0·74	0·98	1·38	1·995	2·998	5·22	6·76	R.
Parts $Th(SO_4)_2$, .	0·88	1·02	1·25	1·85	2·83	4·86	6·5 ±	D.

From $Th(SO_4)_2 + 8H_2O$, 100 parts of water at $t°$ dissolve—

$t°$	0°	15°	25°	44°
Parts $Th(SO_4)_2$, .	1·00	1·38	1·85	3·71

From $Th(SO_4)_2 + 6H_2O$, 100 parts of water at $t°$ dissolve—

$t°$	0°	15°	30°	45°	60°
Parts $Th(SO_4)_2$, .	1·50	1·63	2·45	3·85	6·64

From $Th(SO_4)_2 + 4H_2O$, 100 parts of water at $t°$ dissolve—

$t°$ C.	17°	35°	40°	50°	55°	60°	70°	75°	95°
Parts $Th(SO_4)_2$, .	9·41	4·50	4·04	2·54	1·94	1·634	1·09	1·32	0·71

TABLE LXXIID. 7—*continued.*

10. Solubility of H_3BO_3. (Brandes and Firnhaber.)

t° C.	Weight of Water required to dissolve 1 grm. Substance.		Weight of Substance dissolved in 100 grms. of Water.		Weight of Substance contained in 100 grms. Saturated Aqueous Solution.	
	H_3BO_3.	B_2O_3.	H_3BO_3.	B_2O_3.	H_3BO_3.	B_2O_3.
19°	25·66	47·01	3·9	2·13	3·75	2·11
25	14·88	27·75	6·8	3·60	6·27	3·54
37 ·5	12·66	18·73	7·8	4·24	7·32	4·03
50	10·16	15·13	9·8	6·61	8·96	5·05
62 ·5	6·12	9·29	16·0	10·76	14·04	7·92
75	4·73	7·28	21·0	13·73	17·44	9·83
87 ·5	3·55	5·58	28·0	17·92	21·95	12·38
100	2·97	4·74	34·0	21·09	25·17	14·19

11. One litre of water at t° dissolves. (Ditte.)

t° C.	Grammes of	
	H_3BO_3.	B_2O_3.
0°	19·47	11·00
12	29·20	16·50
20	39·92	22·49
40	69·91	39·50
62	114·16	64·50
80	168·15	95·00
102	291·16	164·50

12. Cobaltous Iodide. (Etard.)

t° C.	Percentage of Salt in Saturated Aqueous Solution.
−22°	52·4
− 8	56·7
− 2	58·7
+ 9	61·4
14	61·6
25	66·4
34	73·0
46	79·0
60	79·2
82	80·7
111	80·9
156	83·1

13. Thallous Chlorate, $TlClO_3$. (Muir.)

100 grammes of Water at	
t° C.	dissolve
0°	2·80
20	3·92
50	12·67
80	36·65
100	57·31

14. Sodium Chlorate, $NaClO_3$. (Schlösing.)

100 grammes of Water at	
t° C.	dissolve
0°	81·9
12	89·3
20	99·0
40	123·5
60	147·1
80	175·6
100	232·6
120	333·3

TABLE LXXIID.—*continued.*

15. Chloraurates. (Rosenbladt.)

$t°$ C.	Weight of Substance in 100 parts Saturated Aqueous Solution.				
	$LiAuCl_4$.	$NaAuCl_4$.	$KAuCl_4$.	$RbAuCl_4$.	$CsAuCl_4$.
10°	53·1	58·2	27·7	4·6	0·5
20	57·7	60·2	38·2	9·0	0·8
30	62·5	64·0	48·7	13·4	1·7
40	67·3	69·4	59·2	17·7	3·2
50	72·0	77·5	70·0	22·2	5·4
60	76·4	90·0	80·2	26·6	8·2
70	81·0			31·0	12·0
80	85·7			35·3	16·3
90				39·7	21·7
100				44·2	27·5

TABLE LXXIIE.—Solutions in Aqueous Ethyl Alcohol.

1. Schiff obtained the following values for the weights of various substances dissolved by 100 grammes of dilute alcohol at 15° C. :—

Specific Gravity of Solution at 15°.	Weight of Alcohol in 100 grms. Solution	Substances.										
		NaCl.	KCl.	$BaCl_2 + 2H_2O$.	$NaNO_3$	KNO_3.	$Na_2SO_4 + 10H_2O$.	K_2SO_4.	$MgSO_4 + 7H_2O$.	$MnSO_4 + 4H_2O$.	$CuSO_4 + 5H_2O$.	$ZnSO_4 + 7H_2O$.
0·986	10	28·5	24·7	31·1	65·3	15·2	16·8	4·1	64·7	105·8	15·3	104·3
972	20	22·5	17·2	21·9	48·8	9·3	5·9	1·48	27·1		3·2	64·0
958	30	17·5	12·0	14·7	35·5	5·9		0·55				
939	40	13·2	8·3	10·2	25·8	4·5	1·3	0·21	1·65		0·25	3·6
917	50	9·8	5·3			2 9				2·04		
895	60	5·9	2·9	3·5	11·4	1·7				0 66		
847	80	1·2	0·45	0·5	2·7	0·4						

TABLE LXXIIE.—*continued.*

2. Gerardin obtained the following results:—
(S = Weight of substance dissolved in 100 parts by weight of the alcoholic solvent).

Specific Gravity at 0°.	Percentage of C_2H_5OH		For KCl.		For $BaCl_2$.	
	By Volume.	By Weight.	Range.	S.	Range.	S
0·9904	7	5·2	0°–52°	23·2 + 0·27t	14°–60°	25·1 + 0·246t
9848	12	9·8	4 –60	19·9 + 0·255t	14 –63	21·6 + 0·225t
9793	19	15·4	4 –43	15·7 + 0·233t	11 –45	17·3 + 0·206t
9726	28	23	3 –34	11·9 + 0·205t	15 –50	13·0 + 0·181t
9573	42	35	10 –60	7·1 + 0·162t	13 –50	8·18 + 0·139t
9390	53	45	2 –57	4·2 + 0·125t	12 –47	5·11 + 0·105t
8967	72	65	12 –65	1·89 + 0·061t	12 –47	2·38 + 0·051t

3. For the values of S at 18° the same investigator obtained the following:—

Specific Gravity at 0°.	Percentage of C_2H_5OH		Values of S for		
	By Volume.	By Weight.	$SrCl_2$.	KI.	$NaC_2H_3O_2$.
0·9904	7	5·2	49·8	130·5	38·0
9848	12	9·8	47·0	119·4	35·9
9726	28	23	39·6	100·1	29·8
9665	35	29	35·9	89·9	27·5
9528	45	38	30·4	76·9	23·5
9390	53	45	26·8	66·4	20·4
9088	67	59	19·2	48·2	14·6
8464	90	86	4·9	11·4	3·9
8322	94	91	3·2	6·2	2·1

4. Employing alcohol of Specific Gravity 0·9390, he obtained the following values for S:—

t° C.	NH_4Cl.	K_2SO_4.	$Pb(NO_3)$.
4°	11·2	0·16	4·96
8	12·6	0·21	5·82
22			8·77
27	19·4		
38	23·6		
40			12·8
50			14·9
56	30·1		
60		0·92	

TABLE LXXIIE.—*continued.*

5. Potassium Chlorate and Potassium Nitrate. (Gerardin.)

Alcohol of Specific Gravity at 0°.	Percentage of C_2H_5OH		$KClO_3$.		KNO_3.	
	By Volume.	By Weight.	$t°$	S.	$t°$	S.
0·9904	7	5·2	13°	4·9	12°	18·1
			21	6·3	21	25·0
			25	7·5	33	40·4
			30	9·1	43	58·6
			35	10·2	53	79·1
			44	13·6	61	94·5
			50	16·2	62	95·7
0·9848	12	9·8	14	4·7	12	14·6
			26	7·1	21	21·7
			39	9·3	36	37·8
			47	12·8	41	45·0
			55	16·1	56	72·9
			65	22·3		
			66	22·5		
0·9793	19	15·4	14	3·2	10	10·195
			26	5·4	13	11·74
			38	7·9	18	14·52
			46	10·8	20	16·35
			51	12·2	31	25·81
			63	17·5	34	28·63
			65	19·0	40	36·66
					41	37·20
					50	50·14
					53	56·01
					61	72·24
					62	73·36
0·9726	28	23	13	2·2	14	8·8
			20	3·3	25	13·6
			33	5·8	34	20·3
			43	7·2	44	31·3
			56	11·4	47	34·2
			59	12·9	60	52·3
0·9573	42	35	13	1·9	14	5·4
			20	2·7	25	9·0

TABLE LXXIIE. 5—*continued.*

Potassium Chlorate and Potassium Nitrate—*continued.*

Alcohol of Specific Gravity at 0° C.	Percentage of C_2H_5OH		$KClO_3$.		KNO_3.	
	By Volume.	By Weight.	$t°$	S.	$t°$	S.
0·9573	42	35	29° C.	3·6	33° C.	13·2
			36	4·3	44	19·1
			55	7·9	57	29·1
			60	9·7	65	36·2
			63	10·5		
0·9390	53	45	14 ·5	1·1	16	4·13
			28	2·2	24	6·00
			40	3·4	40	10·94
			50	4·3	51	16·51
			62	6·6	60	21·54
			67	7·6	64	24·22
0·9111			13	0·74		
			25	1·08		
			32	1·78		
			52	3·35		
0·8967	72	65	12	0·46	12	1·61
			31	1·28	33	3·62
			43	1·95	47	5·77
			58	3·10	57	6·97
0·8429			25	0·09	15	0·29
			34	0·12	22	0·39
			56	0·24	40	0·62
			64	0·32	54	0·78
					60	1·10

TABLE LXXIIE.—*continued.*

6 With alcohol of 0·9282 Sp. Gr. at 0°, Gerardin found the following values for

NaCl						
	t = 4°	10°	13°	32°	44°	60° C.
	S = 10·9	11·1	11·5	12·3	13·1	14·1

7. Sodium Chloride. (Kopp.)

Percentage of C_2H_5OH by Weight.	Weight of NaCl dissolved in 100 grms. Dilute Alcohol.
0·0	35·70
8·4	30·49
16·7	24·84
25·1	19·30
33·4	16·08
41·8	13·28
50·2	11·28
58·5	7·96
66·9	5·95
75·2	3·75
83·6	1·59

8. Silver Nitrate. (Eder.)

Alcohol of Specific Gravity at 15°.	Percentage of C_2H_5OH by Volume.	t.	S.
0·986	10	15° C.	158
975	20	15	107
		50	214
		75	340
964	30	15	73·7
951	40	15	56·4
		50	98·3
		75	160·0
912	60	15	30·5
		50	58·1
		75	89·0
863	80	15	10·3
		50	
		75	42
815	95	15	3·8
		50	7·3
		75	18·3

9. Sodium Nitrate at 16°·5 C. (Bodländer.)

Specific Gravity of Solution.	100 c.cms. of Solution contain		
	Grms. Alc.	Grms. H_2O.	Grms. $NaNO_3$.
1·3745	0	75·25	62·20
3162	6·16	70·82	54·64
2576	11·60	68·10	46·06
2140	16·49	65·04	39·87
1615	22·17	61·67	32·31
0855	32·22	52·92	23·41
0558	37·23	48·50	19·85
0050	43·98	42·78	13·74
0·9420	52·60	32·13	9·47
9030	60·00	25·65	4·65
8610	63·16	21·31	1·63

10. Ammonium Nitrate at 15° C. (Gerlach.)

Specific Gravity of Solution.	NH_4NO_3.	C_2H_5OH.
0·83904	0	100
84746	2	98
85604	4	96
86524	6	94

TABLE LXXIIE.—*continued.*

11. Potassium Nitrate at 18° C. (Bodländer.)

Specific Gravity of Liquid.	100 c.cms. of Solution contain		
	Grms. Alc.	Grms. H_2O.	Grms. KNO_3.
1·1475		89·63	25·12
1085	3·30	87·44	20·11
1010	5·24	86·26	18·60
0805	8·69	83·18	16·18
0655	14·08	77·93	14·54
0490	16·27	76·36	12·27
0375	19·97	72·93	10·85
0·9935	28·11	64·74	6·50
9585	37·53	54·21	4·11
9456	42·98	48·15	3·37
9050	51·23	27·32	1·95
8722	61·65	24·74	0·83
8375	69·60	13·95	0·20

12. Sodium Chloride at 13° C. (Bodländer.)

Specific Gravity of Liquid.	100 c.cms. of Solution contain		
	Grms. Alc.	Grms. H_2O.	Grms. NaCl.
1·2030		88·70	31·60
1348	11·81	78·41	23·26
1144	15·99	74·64	20·81
0970	19·39	71·45	18·86
0698	24·95	65·80	16·23
0295	32·33	57·96	12·66
0·9880	40·33	49·34	9·13
9445	49·28	38·54	5·93
9075	57·91	29·37	3·47
8700	63·86	21·62	1·52
8400	72·26	11·24	0·50

13. Potassium Chloride at 14°·5 C. (Bodländer.)

Specific Gravity of Liquid.	100 c.cms. of Solution contain		
	Grms. Alc.	Grms H_2O.	Grms. KCl.
1·1720		88·10	29·10
1542	2·79	85·78	26·85
1365	4·98	84·00	24·67
1075	10·56	79·63	20·56
1085	15·57	75·24	17·24
0545	20·66	70·52	14·27
0455	24·25	67·05	13·25
0·9695	40·42	50·18	6·35
9315	48·73	40·60	3·82
8448	68·63	15·55	0·30

14. Manganous Chloride in 75% Alcohol. (Brandes.)

t	10°	25°	43°·75	87°·5 C.
% of $MnCl_2$	23·1	36·1	37·5	32·2

Manganous Chloride in Absolute Alcohol.

t	11°·25	37°·5	76°·25 C.
% of MCl_2	33·3	33·3	36·2

Potassium Acetate in 99% Alcohol.

t	15°	80° C.
% of Salt	33·3	50

Caesium Carbonate in 99·5% Alcohol.

t	19°	80° C.
% of Cs_2CO_3	11·1	20·1

15. Mercuric Chloride in Absolute Alcohol. (Schröder.)

Percentage of $HgCl_2$.	Specific Gravity of the Solution at			
	0°	10°	20°	30° C.
0·00	0·83135	0·82286	0·81435	0·80594
1·22	8397	8312	8228	8141
2·38	8484	8399	8314	8227
4·42	8635	8549	8463	8375
8·56	8966	8877	8789	8698
12·43	9306	9213	9119	9024
15·91	9629	9523	9425	9329
19·32	9951	9852	9753	9652
22·46	1·0285	1·0184	1·0083	9982

TABLE LXXIIE.—*continued.*

16. Ammonium Sulphate. (Bodländer.)

Specific Gravity of Solution.	100 c.cms. Solution contain		
	Grms. Alc.	Grms. H_2O.	Grms. $(NH_4)_2SO_4$.
1·2240		71·43	74·16
1775	8·85	68·26	59·54
1735	11·42	66·54	59·20
1661	10·62	67·70	56·56
1655	11·29	67·34	56·30
0·9530	41·37	48·47	5·45
9512	44·20	45·95	4·97
9440	44·27	45·61	4·51
9098	52·64	36·78	1·56
8750	62·61	24·60	0·30
8549	67·04	18·36	0·09
8308	77·55	5·53	0·00

TABLE LXXIIF.—**Mixed Solutions and Solutions in Mixed Solvents.**

In HCl + aqua.

1. Ammonium Chloride. (Engel.)

Specific Gravity.	Gramme Molecules per Litre.			Grammes per Litre.	
	NH_4Cl.	HCl.	Total.	NH_4Cl.	HCl.
1·076	4·6125	0·00	4·6125	246·22	0·00
0695	4·36	0·29	65	232·74	10·55
0705	4·10	0·55	65	218·86	20·00
0715	3·915	0·785	70	208·98	28·55
073	3·645	1·085	730	194·57	39·46
078	2·737	2·14	877	146·10	77·83
106	1·0875	5·30	6·3875	58·05	192·76
114	0·88	6·10	98	46·97	221·86

2. Sodium Chloride. (Engel.)

Specific Gravity.	Gramme Molecules per Litre.			Grammes per Litre.	
	NaCl.	HCl.	Total.	NaCl.	HCl.
1·2045	5·35	0·1	5·45	312·25	3·64
2025	5·22	0·185	405	304·67	6·73
196	4·85	0·51	36	283·07	18·55
185	4·40	0·9275	3275	256·81	33·73
1725	3·795	1·505	300	221·50	54·74
141	2·35	3·075	495	137·16	111·84
1195	0·61	5·635	6·245	35·60	204·94

TABLE LXXIIF.—*continued.*

3. Silver Chloride. (Vogel.)

C.cms. HCl of Sp. Gr. 1·165.	+ c.cms. Water.	Grms. AgCl dissolved.	C.cms. HCl to dissolve 1 grm. AgCl.
100	0·10	0·056	1785
100	20	018	5555
100	30	0089	11235
100	50	0035	18571

4. Thallous Chloride. (Noyes.)

Grms. HCl added.	One part liquid dissolve grms. TlCl.
0	0·01610
0·0283	00836
0·0560	00565
0·1468	00316
1	00200

5. Strontium Chloride. (Engel.)

Specific Gravity.	Gramme Molecules per Litre.			Grammes per Litre.	
	$\frac{1}{2}$ $SrCl_2$.	HCl.	Total.	$SrCl_2$.	HCl.
1·334	5·5	0	5·5	434·61	0
3045	4·82	0·61	43	380·88	22·18
2695	4·125	1·275	40	325·96	45·10
220	3·06	2·33	39	241·80	82·51

6. Barium Chloride. (Engel.)

Specific Gravity.	Gramme Molecules per Litre.			Grammes per Litre.	
	$\frac{1}{2}$ $BaCl_2$.	HCl.	Total.	$BaCl_2$.	HCl.
1·250	2·945	0	2·945	305·69	0
242	2·78	0·11	89	288·56	4·00
228	2·6075	0·28	8875	270·66	10·18
210	2·34	0·50	84	242·89	18·19
143	1·40	1·436	836	145·32	52·23
118	1·02	1·8775	8975	105·98	68·28
099	0·667	2·275	942	69·23	82·74
079	0·274	3·20	3·474	28·44	116·38
088	0·029	5·05	5·079	3·01	183·67

7. Cobaltous Chloride.

Specific Gravity.	Gramme Molecules per Litre.			Grammes per Litre.	
	$\frac{1}{2}CoCl_2$.	HCl.	Total.	$CoCl_2$.	HCl.
1·343	6·24	0	6·24	405·288	0
328	5·8525	0·37	6·2225	380·120	13·489
299	5·08	1·145	6·225	329·946	41·744
248	3·725	2·52	6·245	241·939	91·874
167	1·285	5·50	6·785	83·461	200·519
150	0·475	7·475	7·95	30·851	272·524
229	1·2	10·45	11·65	77·940	380·986
323	2·5	13·9	16·4	162·375	506·766

TABLE LXXIIF.—*continued.*

8. Cupric Chloride. (Engel.)

Specific Gravity.	Gramme Molecules per Litre.			Grammes per Litre.		
	½ $CuCl_2$.	HCl.	Total.	$CuCl_2$.	HCl.	H_2O.
1·490	9·175	0	9·175	614·36	0	873
475	8·68	0·45	9·13	581·21	16·37	874
458	8·32	0·78	9·1	557·11	28·37	
435	7·935	1·05	8·985	531·33	38·19	864
389	6·84	2·025	8·865	458·01	73·62	856
319	5·00	3·75	8·75	334·80	136·39	847
231	2·28	9·305	9·305	152·67	338·42	821
288	2·35	10·25	12·6	157·36	372·79	756
323	2·67	12·8	15·47	178·78	465·54	677

9. Stannous Chloride. (Engel.)

Specific Gravity.	Gramme Molecules per Litre.			Grammes per Litre.		
	½ $SnCl_2$.	HCl.	Total.	$SnCl_2$.	HCl.	H_2O.
1·532	7·4	0	7·4	695·93	0	833
489	6·67	0·66	7·33	627·28	24·00	835
472	6·375	1·354	7·729	599·54	49·24	819·8
524	6·84	2·48	9·32	643·27	90·20	786·9
625	8·12	3·49	11·61	763·65	126·93	730·5
724	9·42	4·00	13·42	885·90	145·48	688·0
883	11·76	4·4	16·16	1105·97	160·03	610·8
2·114	14·76	4·94	19·70	1388·10	179·67	538·7
190	15·64	6·6	22·24	1470·86	240·04	471·5
199	15·7	7·8	23·5	1476·51	283·69	430·9

10. Lead Chloride. (Bell.)

100 parts of liquid containing n parts HCl of Sp. Gr. 1·1162 in 100 parts of water dissolve w parts of $PbCl_2$ at 17°·7 C.

n	w	n	w	n	w	n	w
1	0·347	6	0·107	15	0·090	60	0·559
2	201	7	100	20	111	70	0·933
3	165	8	099	30	151	80	1·498
4	145	9	096	40	216	90	2·117
5	131	10	093	50	356	100	2·900

TABLE LXXII F.—*continued.*

11. Solubility in dilute HCl. (Ditte.)

Parts HCl in 100 pts. aq.	Amount of $PbCl_2$ dissolved in 100 parts of liquid at				
	0°	20°	40°	55°	80°
0·0	8·0	11·8	17·0	21·0	31·0
5·6	2·8	3·0	4·6	6·5	12·4
10·0	1·2	1·4	3·2	5·5	12·0
18·0	2·4	4·8	7·2	9·8	19·8
21·9	4·7	6·2	10·4	12·9	23·8
31·5	11·9	14·1	19·0	24·0	38·0
46·0	29·8	30·0			

12. At 0° C. (Engel.)

Gramme Molecules per Litre.		Grammes per Litre.		Gramme Molecules per Litre.		Grammes per Litre.	
½ $PbCl_2$.	HCl.	$PbCl_2$.	HCl.	½ $PbCl_2$.	HCl.	$PbCl_2$.	HCl.
0·042	0	5·82	0	0·0072	0·58	1·00	21·09
022	0·035	3·05	1·27	0088	1·17	1·22	42·55
0135	0675	1·87	2·45	0100	2·95	1·39	107·29
011	1125	1·52	4·09	0209	4·67	2·90	169·86
0105	16	1·45	5·82	095	7·35	13·16	267·32
0099	23	1·37	8·37	15	8·90	20·78	323·69
0090	34	1·25	12·37	19	9·60	26·33	349·15
0080	45	1·11	16·37	301	11·15	41·71	405·53

13. Mercuric Chloride. (Ditte.)

Parts HCl in 100 parts aq.	Parts $HgCl_2$ dissolved in 100 parts liquid.	Parts HCl in 100 parts aq.	Parts $HgCl_2$ dissolved in 100 parts liquid.
0·0	6·8	21·6	127·4
5·6	46·8	31·0	141·9
10·1	73·7	50·0	148·0
13·8	87·8	68·0	154·0

TABLE LXXIIF.—*continued.*

14. At 0° C. (Engel.)

Sp. Gr.	Gramme Molecules per Litre.			Grammes per Litre.		
	½ $HgCl_2$.	HCl.	Total.	$HgCl_2$.	HCl.	H_2O.
1·117	0·97	0·43	1·40	132·18	15·64	970·4
1·238	1·98	0·99	2·97	269·81	36·01	934·0
1·427	3·55	1·78	5·33	473·76	64·74	891·6
1·665	5·56	2·69	8·25	757·66	97·11	813·5
1·811	6·89	3·225	10·115	938·90	117·29	771·4
1·874	7·237	3·425	10·662	986·19	124·57	767·9
2·023	8·55	4·15	12·70	1165·11	150·94	713·1
2·066	8·865	4·81	13·675	1208·03	174·94	689·3
2·198	9·5675	7·0875	16·655	1303·76	257·77	643·1

15. Calcium Sulphate. (Lunge.)

t° C.	Percentage of HCl.	Grammes of $CaSO_4$ dissolved by 1 Litre.	*t*° C.	Percentage of HCl.	Grammes of $CaSO_4$ dissolved by 1 Litre.
25°	0·77	6·405	**25°**	6·12	16·539
25	1·56	8·821	**101**	0·77	11·209
25	3·06	12·639	**102**	3·06	31·780
25	4·70	15·342	**103**	6·12	46·902

16. Lead Sulphate. (Rodwell.)

Sp. Gr. of HCl + aq.	Percentage of HCl in HCl + aq.	1 Part $PbSO_4$ dissolves in *n* parts of HCl + aq.
1·0159	10·602	681·89
0800	16·310	281·73
1070	22·010	105·65
1359	27·525	47·30
1570	31·602	35·03

17. Calcium Phosphate. (Bischof.)

100 parts HCl of Sp. Gr. 1·153, when diluted with *n* parts of water, dissolve *w* parts of $Ca_3P_2O_8$ at 17° C.

n.	*w*.
0	25·3
1	45·0
4	62·3
7	64·7
10	68·0
13	71·9
16	69·7
19	69·5

TABLE LXXIIF.—*continued.*

In HNO_3 + aqua.

18. Sodium Nitrate. (Engel.)

Gramme Molecules per Litre.			Grammes per Litre.	
$NaNO_3$.	HNO_3.	Total.	$NaNO_3$.	HNO_3.
6·64	0	6·64	563·64	0
6·37	0·265	6·635	540·72	16·67
6·05	0·57	6·62	513·55	35·85
5·69	0·88	6·57	483·00	55·34
5·275	1·257	6·532	447·77	79·05
4·87	1·69	6·56	413·39	106·28
3·95	2·7	6·65	335·30	169·80
3·51	3·225	6·735	297·95	202·82
3·11	3·725	6·835	263·99	234·27
2·35	4·8	7·15	199·48	301·87
1·8	5·73	7·53	152·79	360·36
1·29	7·1	8·39	109·50	446·52

19. Potassium Nitrate. (Engel.)

Gramme Molecules per Litre.			Grammes per Litre.	
KNO_3.	HNO_3.	Total.	KNO_3.	HNO_3.
1·25	0	1·25	126·15	0
0·99	0·585	1·575	99·91	36·79
0·828	1·32	2·148	83·56	83·01
0·74	2·155	2·895	74·68	135·53
0·74	3·11	3·85	74·68	195·59
0·76	4·8	5·56	76·70	301·87
1·03	6·8	7·83	103·95	427·65
2·83	12·05	14·88	285·60	757·82

20. Lead Sulphate. (Rodwell.)

Sp. Gr. of HNO_3 + aq.	Percentage of HNO_3 in HNO_3 + aq.	1 part $PbSO_4$ dissolves in n parts of HNO_3 + aq.
1·079	11·55	303·10
123	17·50	173·75
250	34·00	127·48
420	60·00	10282·78

TABLE LXXIIF.—*continued.*

21. Calcium Phosphate. (Bischof.)

If 1 part of HNO_3 (Sp. Gr. 1·23) be diluted with n parts of water, then 1 part of $Ca_3P_2O_8$ will dissolve in p parts of such solution at 16°·25 to 17°·5 C.

n.	*p.*	*n.*	*p.*	*n.*	*p.*
0	2·72	8·273	20·34	13·236	32·14
0·827	4·23	10	82	15·718	36·06
3·309	10·25	10·754	64	40	127·81
5·791	15·45	13	26·48		

22. Rüdorff found that the following pairs of salts gave, at the temperatures stated, saturated solutions of constant composition.

Composition of Pair. *a* *b*	t° C.	Saturated Solution contains, per 100 parts aqua, *a*	*b*	100 parts of water at t° dissolve of *a* alone	*b* alone	Authority.
$NH_4Cl + NaCl$	18°·7	22·9 +	23·9	22·0	36·4	Rüdorff
$+ KCl$	22	30·4 +	19·1	38·0	35·3	,,
$+ BaCl_2$	20	33·8 +	11·6	37·2	35·7	,,
$+ NH_4NO_3$	19·5	29·1 +	173·8	37·0	183·0	,,
$+ (NH_4)_2SO_4$	21·5	26·8 +	46·5			,,
$+ K_2SO_4$	14·1	36·8 +	14·1			,,
$NaCl + KCl$	18·8	29·9 +	15·7	36·0	34·3	,,
$+ CuCl_2$	15	16·0 +	72·6			,,
$+ NaNO_3$	20	24·6 +	56·8			,,
$KCl + KI$	21·5	10·4 +	133·2	35·2	146·2	,,
$+ KNO_3$	20	35·2 +	19·1			,,
$NH_4NO_3 + NaNO_3$	16	162·9 +	77·1	106·0	84·7	,,
$KNO_3 + Pb(NO_3)_2$	21·2	67·1 +	119·6	32·6	53·3	,,
$Na_2SO_4 + CuSO_4$	15	15·9 +	20·7	13·4	20·5	,,

23. The following results have been obtained by other investigators :—

Composition of Pair. *a* *b*	t° C.	Saturated Solution contains, per 100 parts aqua, *a*	*b*	100 parts of water at t° dissolve of *a* alone	*b* alone	Authority.
$NH_4Cl + NaCl$	10°	19·50 +	30·00	33·0	35·8	Mulder
	13	18·8 +	24·6			v. Hauer
	16	20·3 +	26·1			,,
	18·75	22·06 +	26·38	37·02		Karsten
	B.P.	78·5 +	22·3	87·3	40·4	Mulder
$+ KCl$	15°	28·90 +	16·97			Rüdorff
	18·75	29·83 +	16·27	37·02	34·4	Karsten
	B.P.	67·7 +	21·9	87·3	58·5	Mulder

TABLE LXXIIF. 23—*continued.*

Composition of Pair. a	Composition of Pair. b	$t°$ C.	Saturated Solution contains, per 100 parts aqua, a		Saturated Solution contains, per 100 parts aqua, b	100 parts of water at $t°$ dissolve of a alone	b alone	Authority.
NH_4Cl	$+ KNO_3$	18°·5	(a) 44·33	+	30·56	36·7	29·9	Various
			(b) 37·98	+	37·68			Various
			(c) 39·84	+	38·62			Various
			(d) 38·8	+	34·2			Various
	$+ Ba(NO_3)_2$	18 ·5	(e) 38·6	+	8·6	36·7	8·9	Karsten
			(f) 38·06	+	16·73			"
			(g) 39·18	+	17·02			"
	$+ K_2SO_4$	18 ·75	(h) 38·2	+	11·1	36·7	10·8	"
			(i) 37·94	+	13·26			"
			(j) 37·92	+	13·28			"
		B.P.	(k) 90·4 to 111·8	+	33·3 to 33·9	87·3	26·75	Mulder
	$+ Na_2SO_4$	10°–11°	(l) 28·9	+	24·7			"
			(m) 31·8	+	9·0			"
$NaCl$	$+ KCl$	15°·6	30·65	+	13·92			Page & Keightley
		20	30·54	+	13·99			Nicol
		10	29·7	+	12·5			Precht & Wittgen
		20	29·2	+	14·7			"
		30	28·7	+	17·2			"
		40	28·2	+	19·5			"
		50	27·7	+	22·0			"
		60	27·2	+	24·6			"
		70	26·8	+	27·3			"
		80	26·4	+	30·0			"
		90	26·1	+	32·9			"
		100	25·8	+	34·7			"
	$+ BaCl_2$	17	4·1	+	34·5	35·9	35·0	Kopp
		B.P.	35·3	+	19·4	40·4	60·3	Mulder
		10°	33·9	+	4·1			Precht & Wittgen
		20	33·8	+	4·1			"
		30	33·7	+	5·0			"
		40	33·6	+	6·3			"
		50	33·5	+	7·9			"
		60	33·5	+	9·7			"
		70	33·6	+	11·7			"
		80	33·6	+	13·9			"
		90	33·6	+	15·9			"
		100	33·6	+	17·9			"
	$+ NaNO_3$	20	54·55	+	24·91			Nicol
		18 ·75	(n) 25·22	+	52·89	36·0	86·6	Karsten
			(o) 24·96	+	52·84			"
			(p) 24·98	+	52·82			"
		20	(q) 24·6	+	56·8			Rüdorff

TABLE LXXIIF. 23—*continued.*

Composition of Pair. a	b	$t°$ C.	Saturated Solution contains, per 100 parts aqua, a		b	100 parts of water at $t°$ dissolve of a alone	b alone	Authority.
$NaCl$	+ KNO_3	4°	35·96	+	26·01			Longchamp
		14	38·5	+	28·7			Rüdorff
		15 ·6	39·57	+	32·32			Page & Keightley
		18	38·9	+	36·1			Rüdorff
		18 ·75	(r) 36·53	+	33·12			Karsten
			(s) 38·25	+	29·45			”
			(t) 39·19	+	38·53			”
		B.P.	37·9	+	306·7			Mulder
	+ Na_2CO_3	15°	(u) 0	+	16·408			Reich
			1	+	15·717			”
			2	+	15·060			”
			3	+	14·438			”
			4	+	13·851			”
			5	+	13·299			”
			6	+	12·783			”
			7	+	12·305			”
			8	+	11·864			”
			9	+	11·461			”
			10	+	11·097			”
			11	+	10·773			”
			12	+	10·488			”
			13	+	10·244			”
			14	+	10·041			”
			15	+	9·880			”
			16	+	9·762			”
			17	+	9·686			”
			18	+	9·655			”
			19	+	9·667			”
			20	+	9·725			”
			21	+	9·828			”
			22	+	9·997			”
	+ (Na_2CO_3 + $10H_2O$)	15	(v) 0·00	+	61·42			”
			4·03	+	53·86			”
			8·02	+	48·00			”
			12·02	+	43·78			”
			16·05	+	40·96			”
			19·82	+	39·46			”
			23·70	+	39·06			”
			27·93	+	39·73			”
			31·65	+	41·44			”
			35·46	+	43·77			”
			(s, a, t) 37·27	+	45·32			”
	+ K_2SO_4	14	(w) 37·60	+	7·03			Rüdorff

TABLE LXXIIF. 23—*continued.*

Composition of Pair. a b	t° C.	Saturated Solution contains, per 100 parts aqua, a		b	100 parts of water at t° dissolve of a alone.	b alone.	Authority.
$KCl + MgCl_2$	10°	1·9	+	(30%)			Precht & Wittgen
	20	2·6		„			„
	30	3·4		„			„
	40	4·2		„			„
	50	5·0		„			„
	60	5·8		„			„
	70	6·5		„			„
	80	7·3		„			„
	90	8·1		„			„
	100	8·9		„			„
	10	5·3	+	(21·2%)			„
	20	6·5		„			„
	30	7·6		„			„
	40	8·8		„			„
	50	10·0		„			„
	60	11·2		„			„
	70	12·4		„			„
	80	13·6		„			„
	90	14·7		„			„
	100	15 9		„			„
	10	9·9	+	(15%)			„
	20	11·3		„			„
	30	12·7		„			„
	40	14·2		„			„
	50	15·6		„			„
	60	17·0		„			„
	70	18·3		„			„
	80	19·5		„			„
	90	20·8		„			„
	100	22·1		„			„
	10	14·3	+	(11%)			„
	20	15·9		„			„
	30	17·5		„			„
	40	19·0		„			„
	50	20·5		„			„
	60	21·9		„			„
	70	23·2		„			„
	80	24·5		„			„
	90	25·8		„			„
	100	27·1		„			„
$+ SrCl_2$	14 ·5	11·2	+	48·5	33·2	50·7	Mulder
$+ KNO_3$	12 ·9	28·5	+	18·8			Kopp
	15 ·3	29·8	+	18·9			„
	20	31·52	+	19·1			Rüdorff
	20	32·84	+	18·95			Nicol

TABLE LXXIIF. 23—*continued.*

Composition of Pair.		$t°$ C.	Saturated Solution contains, per 100 parts aqua,		100 parts of water at $t°$ dissolve of		Authority.
a	b		a	b	a alone.	b alone.	
KCl	$+ K_2SO_4$	18°·75	(x) 32·96 +	1·79	34·5	10·8	Karsten
			(y) 33·12 +	1·75			,,
			(z) 33·12 +	1·83			,,
		14 ·8	28·2 +	2·0	33·5	10·3	Kopp
		15 ·8	27·9 +	2·3	33·6	10·4	,,
		16 ·1	27·1 +	3·3	33·6	10·4	,,
		10	30·9 +	1·32			Precht & Wittgen
		20	33·4 +	1·43			,,
		30	36·1 +	1·57			,,
		40	38·7 +	1·69			,,
		50	41·3 +	1·82			,,
		60	43·8 +	1·94			,,
		70	46·5 +	2·06			,,
		80	49·2 +	2·21			,,
		90	52·0 +	2·38			,,
		100	54·5 +	2·53			,,
NH_4NO_3	$+ KNO_3$	11	(a_1) 88·8 +	40·6	143	26	Mulder
		15	(b_1) 130·4 +	46·2	161		,,
	$+ Ba(NO_3)_2$	9	101·3 +	6·2	143	6·8	,,
$NaNO_3$	$+ KNO_3$	15 ·6	91·16 +	34·53			Page & Keightley
		18 ·75	(c_1) 89·53 +	29·45			Karsten
			(d_1) 88·00 +	35·79			,,
		20	94·60 +	39·34			Nicol
	$+ Sr(NO_3)_2$	14 ·5	(e_1) 66·4 +	51·0	83·7	62·0	Mulder
	$+ Ba(NO_3)_2$	18 ·75	(f_1) 88·14 +	3·77	86·6	8·9	Karsten
		20 ·2	88·6 +	3·6	87·7	9·2	Kopp
KNO_3	$+ Ba(NO_3)_2$	18 ·5	(g_1) 28·8 +	5·4	29·7	8·9	Mulder
			(h_1) 13·31 +	6·91			Karsten
			(i_1) 29·03 +	1·00			,,
		21 ·5	(j_1) 33·1 +	5·7			Kopp
		23	(k_1) 36·3 +	3·5			,,
Na_2SO_4	$+ CuSO_4$	0	(l_1) 4·53 +	0			Diacon
			(m_1) 5·34 +	6·01			,,
			(n_1) 5·73 +	9·81			,,
			(o_1) 6·48 +	16·67			,,
			(p_1) 3·55 +	15·84			,,
			(q_1) 1·98 +	15·33			,,
			(r_1) 0 +	14·99			,,
$MgSO_4$	$+ CuSO_4$		(s_1) 26·37 +	0			,,
			(t_1) 25·91 +	2·64			,,
			(u_1) 25·30 +	4·75			,,
			(v_1) 23·54 +	9·01			,,
			(w_1) 15·67 +	12·03			,,
			(x_1) 8·64 +	13·61			,,
			(y_1) 0 +	14·99			,,

TABLE LXXIIF. 23.—*continued.*

NOTES.

(*a*) Saturated KNO_3 + aq. treated with NH_4Cl.
(*b*) Saturated NH_4Cl + aq. treated with KNO_3.
(*c*) Simultaneous treatment of NH_4Cl and KNO_3.
(*d*) By warming solution containing excess of both salts, and cooling to 14°·8 C.
(*e*) Saturated $Ba(NO_3)_2$ + aq. treated with NH_4Cl.
(*f*) Saturated NH_4Cl + aq. treated with $Ba(NO_3)_2$.
(*g*) Simultaneous treatment of NH_4Cl and $Ba(NO_3)_2$.
(*h*) Saturated K_2SO_4 + aq. treated with NH_4Cl.
(*i*) Saturated NH_4Cl + aq. treated with K_2SO_4.
(*j*) Simultaneous treatment of NH_4Cl and K_2SO_4.
(*k*) Weights dissolved in 100 parts of water.
(*l*) 100 parts water saturated with NH_4Cl at 10°, and then with Na_2SO_4 at 11° C.
(*m*) 100 parts water saturated with Na_2SO_4 at 10°, and then with NH_4Cl at 11° C.
(*n*) Saturated NaCl + aq. treated with $NaNO_3$.
(*o*) Saturated $NaNO_3$ + aq. treated with NaCl.
(*p*) Simultaneous treatment of NaCl and $NaNO_3$.
(*q*) By warming solution containing excess of both salts, and cooling to 20° C.
(*r*) Saturated NaCl + aq. treated with KNO_3.
(*s*) Saturated KNO_3 + aq. treated with NaCl.
(*t*) Simultaneous treatment of NaCl and KNO_3.
(*u*) Solubility of anhydrous Na_2CO_3 in 100 parts NaCl + aq. containing % NaCl.
(*v*) Amounts dissolved in 100 parts of water when $Na_2CO_3 + 10H_2O$ is in excess.
(*w*) By warming solution containing excess of both salts, and cooling to 14° C.
(*x*) Saturated KCl + aq. treated with K_2SO_4.
(*y*) Simultaneous treatment of KCl and K_2SO_4.
(*z*) Saturated K_2SO_4 + aq. treated with KCl.
(a_1) 100 parts water saturated at 11° with NH_4NO_3, then at 9° with KNO_3.
(b_1) 100 parts water saturated at 11° with NH_4NO_3, then at 15° with KNO_3.
(c_1) Saturated KNO_3 + aq. treated with $NaNO_3$.
(d_1) Saturated $NaNO_3$ + aq. treated with KNO_3.
(e_1), (f_1), (g_1) Weights dissolved in 100 parts water.
(h_1) Saturated KNO_3 + aq. treated with $Ba(NO_3)_2$.
(i_1) Saturated $Ba(NO_3)_2$ + aq. treated with KNO_3.
(j_1), (k_1) Simultaneous treatment of KNO_3 and $Ba(NO_3)_2$.
(l_1), (m_1), (n_1) Na_2SO_4 in excess, and given amount of $CuSO_4$ added.
(o_1) Both in excess.
(p_1), (q_1), (r_1) $CuSO_4$ in excess, and Na_2SO_4 added.
(s_1), (t_1), (u_1) $MgSO_4$ in excess, and given amount of $CuSO_4$ added.
(v_1) Both in excess.
(w_1), (x_1), (y_1) $CuSO_4$ in excess, and $MgSO_4$ added.

TABLE LXXIIF.—*continued.*

24. For the three salts, $NaCl + KCl + K_2SO_4$, Precht and Wittgen obtained the following results :—

100 parts of water at $t°$ C. dissolve			
° C.	Parts NaCl.	Parts KCl.	Parts K_2SO_4.
10°	33·43	3·18	8·10
20	34·01	3·06	8 90
30	34·56	2·95	9·56
40	35·16	2·81	10·38
50	35·77	2·84	11·07
60	36·40	2·72	11·93
70	36·64	3·20	12·82
80	36·04	5·06	12·26
90	35·86	6·98	12·42
100	35·63	8·79	12·56

25. Solubility of $KCl + NaCl$ in 20% aqueous Solution of $MgCl_2$. (Precht and Wittgen.)

$t°$ C.	Percentage of NaCl.	Percentage of KCl.
10°	5·7	4·2
20	5·8	5·1
30	5·9	6·0
40	6·0	6·9
50	6·1	7·9
60	6·3	8·9
70	6·4	9·9
80	6·6	10·9
90	6·7	11·9
100	6·9	13·0

TABLE LXXIIF.—*continued.*

26. Solubility of Mixtures of $NaNO_3$ and KNO_3. (Carnelley and Thomson.)

Percentage $NaNO_3$ in Mixture before Solution.	Weight of Mixture dissolved in 100 parts Water at 20° C.	Parts $NaNO_3$ dissolved.	Parts KNO_3 dissolved.	Percentage $NaNO_3$ in Residue after evaporating Solution to Dryness.
100	86·8	86·8	0	100
90	109·6	96·4	13·2	88
80	136·5	98·0	38·5	71·8
70	136·3			
60	137·6	90·0	47·6	65·4
50	106·1	66·0	40·1	62·2
45·7	88·0	53·3	34·7	60·6
40	81·1	45·6	35·6	56·2
30	73·5			
20	54·1	20·8	33·3	38·5
10	40·9	9·4	31·5	22·9
0	33·6	0	33·6	0

27. Specific Gravity and Concentration of Ammoniacal Solutions of NH_4Cl. (Engel.)

Specific Gravity	Gramme Molecules per Litre.		Grammes per Litre.	
	NH_4Cl.	NH_3.	NH_4Cl.	NH_3.
1·076	4·6125	0	246·22	0
067	58	0·537	244·48	9·13
054	55	1·2025	242·88	20·45
044	5125	2·34	240·88	39·80
031	45	3·8	237·54	64·64
025	40	4·7	234·87	79·95
017	3625	5·45	232·87	92·70
0·993	3125	8·00	230·20	136·08
992	40	9·00	234·87	153·09
983	4375	9·55	236·87	162·45
954	975	13 0	265·57	221·13
931	6·0	16·975	320·28	288·59

TABLE LXXIIF.—*continued.*

28. Solubility of NaCl with the addition of $NaNO_3$ at 15°·5 C. (Bodländer.)

Specific Gravity.	One Litre contains in Grammes		
	NaCl.	$NaNO_3$.	H_2O.
1·2025	317·8	0·0	884·7
2305	278·9	75·3	876·3
2580	263·1	132·4	862·5
2810	239·8	215·8	826·6
3090	223·0	281·8	804·2
3345	204·0	338·0	792·5
3465	194·0	378·8	773·7
3465	196·7	376·4	773·4

In the last two cases $NaNO_3$ separated out.

29. Solubility of $NaNO_3$ with the addition of NaCl at 15° C. (Bodländer.)

Specific Gravity.	One Litre contains in Grammes		
	$NaNO_3$.	NaCl.	H_2O.
1·3720	623·8	0	748·2
3645	565·6	40	756·9
3585	520·9	72·4	757·1
3530	470·8	113·6	768·6
3495	426·6	153·3	769·6
3485	399·0	178·1	771·4
3485	387·3	189·7	771·5
3485	380·2	193·4	774·9

In the last two instances NaCl separated out.

TABLE LXXIIF.—*continued.*

30. Solubility of NaCl in NaOH. (Engel.)

Specific Gravity.	Gramme Molecules per Litre.			Grammes per Litre.	
	NaCl.	Na_2O.	Total.	NaCl.	Na_2O.
1·207	5·47	0	5·47	319·26	0
221	4·9375	0·48	4175	288·18	29·74
225	4·7212	0·6725	3937	275·55	41·66
236	4·2375	1·0406	2781	247·32	64·46
249	3·955	1·478	433	230·83	91·56
295	2·495	3·05	545	145·62	188·75
314	1·93	3·7875	7175	112·64	234·63
362	0·9408	5·325	6·266	54·91	329·88

31. Solubility of KCl with addition of KNO_3 at 17°·5. (Bodländer.)

Specific Gravity.	One Litre of Solution contains Grammes of		
	KCl.	KNO_3.	H_2O.
1·1730	293·9	0	878·5
1980	275·0	65·8	856·8
2100	273·4	88·3	847·6
2250	265·3	124·8	835·8
2360	259·8	148·3	828·4
2390	259·6	152·2	826·5
2388	259·5	154·9	824·3
2410	262·4	153·3	826·3

In the last four instances KNO_3 separated out.

TABLE LXXII F.—*continued.*

32. Solubility of KNO_3 with addition of KCl at 20°·5 C. (Bodländer.)

Specific Gravity.	One Litre of the Solutions contains Grms. of		
	KNO_3.	KCl.	H_2O.
1·1625	276·8	0	885·1
1700	243·9	47·2	878·9
1765	224·4	77·4	874·7
1895	202·3	122·3	864·8
1983	189·6	151·5	856·9
2150	176·7	196·1	842·3
2265	171·1	221·7	834·0
2400	167·9	249·6	822·4

33. Solubility of KCl in KOH + aq. at 0° C. (Engel.)

Specific Gravity.	Gramme Molecules per Litre.			Grammes per Litre.	
	KCl.	K_2O.	Total.	KCl.	K_2O.
1·139	3·45	0	3·45	256·68	0
146	3·1	0·2375	3375	230·64	22·33
153	2·83	0·47	3	210·55	44·19
172	2·3	0·99	29	171·12	93·08
195	1·8375	1·506	3435	136·71	141·59
216	1·4425	2·0	4425	107·32	188·04
239	1·1425	2·4625	6050	85·00	231·52
261	0·8975	2·925	8225	66·77	275·00
294	0·6275	3·5125	4 14	46·69	330·24

34. Solubility of $NaNO_3$ in NaOH + aq. at 0° C. (Engel.)

Specific Gravity.	Gramme Molecules per Litre.			Grammes per Litre.	
	$NaNO_3$.	Na_2O.	Total.	$NaNO_3$.	Na_2O.
1·341	6·64	0	6·64	563·64	0
338	6·25	0·2875	6·5375	530·53	17·82
333	5·715	0·61	6·325	485·12	37·79
327	4·75	1·275	6·025	403·20	78·99
326	2·95	2·6	5·55	250·41	161·07
332	1·75	3·9	5·65	148·55	241·61
356	1·319	4·5875	5·9065	111·96	284·19
401	0·605	6·0875	6·6925	51·36	377·12

35. Solubility of K_2SO_4 in NH_4OH + aq. (Girard.)

Grammes in 1 Litre Water.		Grammes in 1 Litre Water.	
NH_3.	K_2SO_4.	NH_3.	K_2SO_4.
0	108·04	246·9	1·40
60·8	41·00	310·2	0·42
153·7	8·28		

TABLE LXXIIG.—Preparation of Solutions of known Strengths.

Percentage of Substance in Solution.	Weight of Substance to be added to 100 parts of Water.		Percentage of Substance in Solution.	Weight of Substance to be added to 100 parts of Water.		Percentage of Substance in Solution.	Weight of Substance to be added to 100 parts of Water.		Percentage of Substance in Solution.	Weight of Substance to be added to 100 parts of Water.	
1	1·0101	99	26	35·1351	74	51	104·0816	49	76	316·6667	24
2	2·0408	98	27	36·9863	73	52	108·3333	48	77	334·7826	23
3	3·0928	97	28	38·8889	72	53	112·7660	47	78	354·5455	22
4	4·1667	96	29	40·8451	71	54	117·3913	46	79	376·1905	21
5	5·2632	95	30	42·8571	70	55	121·1111	45	80	400·0000	20
6	6·3830	94	31	44·9275	69	56	127·2727	44	81	426·3158	19
7	7·5269	93	32	47·0588	68	57	132·5581	43	82	455·5556	18
8	8·6957	92	33	49·2537	67	58	138·0952	42	83	488·2353	17
9	9·8901	91	34	51·5152	66	59	143·9024	41	84	525·0000	16
10	11·1111	90	35	53·8462	65	60	150·0000	40	85	566·6667	15
11	12·3596	89	36	56·2500	64	61	156·4103	39	86	614·2857	14
12	13·6364	88	37	58·7302	63	62	163·1579	38	87	670·8615	13
13	14·9425	87	38	61·2903	62	63	169·2703	37	88	733·3333	12
14	16·2791	86	39	63·9344	61	64	177·7778	36	89	809·0909	11
15	17·6471	85	40	66·6667	60	65	185·7143	35	90	900·0000	10
16	19·0476	84	41	69·4915	59	66	194·1176	34	91	1011·1111	9
17	20·4819	83	42	72·4138	58	67	203·0303	33	92	1150·0000	8
18	21·9512	82	43	75·4386	57	68	212·5000	32	93	1328·5714	7
19	23·4568	81	44	78·5714	56	69	222·5806	31	94	1566·6667	6
20	25·0000	80	45	81·8182	55	70	233·3333	30	95	1900·0000	5
21	26·5823	79	46	85·1852	54	71	244·8276	29	96	2400·0000	4
22	28·2051	78	47	88·6792	53	72	257·1429	28	97	3233·3333	3
23	29·8701	77	48	92·3077	52	73	270·3704	27	98	4900·0000	2
24	31·5789	76	49	96·0784	51	74	284·6154	26	99	9900·0000	1
25	33·3333	75	50	100·0000	50	75	300·0000	25			
	Weight of Water to be added to 100 parts of Substance.	Percentage of Substance in Solution.		Weight of Water to be added to 100 parts of Substance.	Percentage of Substance in Solution.		Weight of Water to be added to 100 parts of Substance.	Percentage of Substance in Solution.		Weight of Water to be added to 100 parts of Substance.	Percentage of Substance in Solution.

The use of the preceding table is self-evident. Thus, if it is required to make a solution containing 52 per cent. of any soluble substance by looking for 52 in the first column, we find from the second column that we must add 108·3333 grammes of the substance to 100 grammes of water; or, by looking for 52 in the third column, we find from column 2 that we should have to add 92·3077 grammes of water to 100 grammes of the substance.

If P = percentage of substance in the stronger of two solutions,
and p = " " weaker " "

∴ weight of water that must be added to 1 unit weight of the stronger to produce the weaker $= \frac{P}{p} - 1$; and weight of substance which must be added to 1 unit weight of the weaker to bring it up to the higher strength $= \frac{100 - p}{100 - P} - 1$.

For example, a solution of sulphuric acid of 55 degrees Baumé contains 70 per cent. of H_2SO_4, how much water must be added to every gramme of such solution to reduce it to 31 degrees Baumé contained in 36 per cent. H_2SO_4?

$$\text{Here } \frac{P}{p} - 1 = \frac{70}{36} - 1 = 0{\cdot}94 \text{ gramme.}$$

In 1 gramme of 70 per cent. solution we have ·7 gramme of H_2SO_4,

$$\therefore \text{ Percentage of } H_2SO_4 \text{ in diluted solution} = \frac{0{\cdot}7 \times 100}{1 + 0\ 94} = 36.$$

As there is, in nearly every instance, a change in the total volume when two liquids of different densities or constitutions are mixed together, no simple formula can be given for diluting or fortifying volumetrically a solution of any given density to produce another of a required density: where the percentage of substance held in solution in each case is known, as well as the densities, then the calculation can be easily made.

If P, D, and V represent respectively the percentage contents, density, and volume of a comparatively strong solution; p, d, and v, the corresponding values for a weaker one; and p, d, and v, those obtained by mixing V c.cms. of the first and v c.cms. of the second.

$$\text{Then, if } v = 1, \text{ we get } V = \frac{d(\mathrm{p} - p)}{D(P - \mathrm{p})}; \text{ or } v = 1 \text{ litre} \therefore V = 1000 \cdot \frac{d(\mathrm{p} - p)}{D(P - \mathrm{p})} \text{ c.cms.} \qquad (1)$$

$$\text{And if } V = 1 \therefore v = \frac{D(P - \mathrm{p})}{d(\mathrm{p} - p)}; \text{ or } V = 1 \text{ litre} \therefore v = 1000\, \frac{D(P - p)}{d(\mathrm{p} - p)} \quad \ldots\ldots\ldots \quad (2)$$

$$\text{And, finally, if } \mathrm{v} = 1 \therefore V = \frac{\mathrm{d}}{D} \cdot \frac{\mathrm{p} - p}{P - p}; \text{ and } v = \frac{\mathrm{d}}{d} \cdot \frac{P - \mathrm{p}}{P - p};$$

$$\text{or } \mathrm{v} = 1 \text{ litre} \therefore V = 1000 . \frac{\mathrm{d}}{D} \cdot \frac{\mathrm{p} - p}{P - p} \text{ c.cms., and } v = 1000\, \frac{\mathrm{d}}{d} \cdot \frac{P - p}{P - p} \text{ c.cms.} \quad \ldots \quad (3)$$

Should p become 0, *i.e.* if the second liquid be water ($d = 1$), then equation (1) becomes—

$$V = \frac{\mathrm{p}}{D(P - \mathrm{p})}; \text{ and for } v = 1 \text{ litre, } V = \frac{1000\mathrm{p}}{D(P - \mathrm{p})} \text{ c.cms} \quad \ldots\ldots \quad (4)$$

(2) becomes $v = \frac{D(P-p)}{p}$; and for V = 1 litre, $v = \frac{1000D(P-p)}{p}$ . . . . . (5)

and (3) for v = 1 litre gives $V = 1000.\frac{dp}{DP}$ c.cms., and $v = 1000.\frac{d(P-p)}{P}$ c.cms. . . . (6)

For example, if we required to know in what proportions solutions of sulphuric acid of density = 1·4, percentage $H_2SO_4 = 50{\cdot}11$, and density = 1·1, percentage of $H_2SO_4 = 14{\cdot}35$, respectively, must be mixed to make up a litre of density 1·3 and percentage $H_2SO_4 = 39{\cdot}19$, we get by equation (3)—

$$V = 1000.\frac{1{\cdot}3}{1{\cdot}4}.\frac{39{\cdot}19 - 14{\cdot}35}{50{\cdot}11 - 14{\cdot}35} = 645{\cdot}006 \text{ c.cms.}$$

$$v = 1000.\frac{1{\cdot}3}{1{\cdot}1}.\frac{50{\cdot}11 - 39{\cdot}19}{50{\cdot}11 - 14{\cdot}35} = 360{\cdot}891 \text{ c.cms.}$$

Weight of H_2SO_4 in $V = 645{\cdot}006 \times 1{\cdot}4 \times 0{\cdot}5011 = 452{\cdot}498$ grms.
" " " $v = 360{\cdot}891 \times 1{\cdot}1 \times 0{\cdot}1435 = 56{\cdot}967$ "
Total . . . . $= 509{\cdot}465$ grms.

Weight of H_2SO_4 in 1 litre of 1·3 density $= 1000 \times 1{\cdot}3 \times 0{\cdot}3919 = 509{\cdot}467$ "

If we desired to find the weights (W and w) of the strong and weak solutions which must be put together to make up 1 litre of the medium, we get—

$$\left.\begin{aligned} W &= 1000d.\frac{p-p}{P-p} \text{ grms.} \\ \text{and } w &= 1000d.\frac{P-p}{P-p} \text{ grms.} \end{aligned}\right\} \quad \ldots\ldots\ldots\ldots \quad (7)$$

and when $p = 0$, (7) becomes—

$$\left.\begin{aligned} W &= 1000d\frac{p}{P} \\ w &= 1000d.\frac{P-p}{P} \end{aligned}\right\} \quad \ldots\ldots\ldots\ldots \quad (8)$$

The volume and density of a mixture of solutions can only be ascertained by experiment or by reference to tables giving the results of actual trials.

TABLE LXXIIH.—**Relations of Solubility to Pressure, Temperature, etc.**

Sorby, investigating the influence of pressure on solubility, obtained the following results:—

Substance.	a	b	c	d
Ammonium chloride, ...	∠0	164	− 1·045	− 0·638
Sodium chloride, ...	13·57	97	+ 0·407	+ 0·419
Copper sulphate, ...	4·83	60	1·91	3·183
Potassium ferricyanide, . . .	2·51	86	0·288	0·395
Potassium sulphate, ...	31·21	63	1·84	2·914
Potassium ferrocyanide, . . .	8·90	66	1·64	2·845

TABLE LXXIIH.—*continued.*

a = Increase of volume of salt in crystallising out of saturated solution, expressed in percentages of the solid salt.
b = Pressure in atmospheres.
c = Percentage increase of solubility under pressures given in b (originally dissolved salt = 100).
d = Corresponding increments under pressure of 100 atmospheres.
From these he deduces the expression :—

$$S_p = S_o + \frac{pc}{m},$$

where m is a function of the mechanical equivalent of the force of crystallisation.

K. Möller obtained the following values for the amount of salt dissolved in 100 parts of water under various pressures and at various temperatures :—

(1) Sodium Chloride.

p in atmos.	$t^\circ = 0^\circ$	9°	15°	20°	25°	30°
1	35·59	35·72	35·70	35·78	35·81	36·01
20	35·79	35·84	35·84	35·82	35·99	36·10
40	35·95		35·87			

(1*a*) Sodium Sulphate.

p	$t = 0^\circ$	15°
1	4·60	12·76
20	4·74	11·88
30		11·77
40		11·53

(1*b*) Potassium Sulphate.

p	$t = 0^\circ$	15°·5	16°·2
1	7·31	10·19	10·32
20	7·68	10·43	10·54
30	7·69		

TABLE LXXIIH. (2).

The expressions for the relations between solubility and temperature are practically all empirical. In the following, S_t = weight of substance dissolved in 100 grammes of water at temperature $t°$:—

Substance.	Range of Temp.	S_t	Authority.
NH_4Cl,	0° to 100°	$29{\cdot}7+0{\cdot}35t+0{\cdot}00125t^2$	
	100 –116	$29{\cdot}7+0{\cdot}3218t+0{\cdot}001542t^2$	
$LiCl$,	0 – 65	$63{\cdot}7+0{\cdot}949t-0{\cdot}005t^2$	
$NaCl$,	0 –100	$35{\cdot}5+0{\cdot}025\dot{3}t+0{\cdot}0_48t^2+0{\cdot}0_510\dot{6}t^3$	
	above 20°	$34{\cdot}359+0{\cdot}0527t$	Coppet.
	0°– 10°	$35{\cdot}7+0{\cdot}024t+0{\cdot}0_32t^2$	Mendelejeff.
	0 –100	$35{\cdot}63+0{\cdot}007889(t-4)+0{\cdot}0_33113(t-4)^2$	Andreæ.
KCl,	–11 – 92	$28{\cdot}51+0{\cdot}2837t$	Coppet.
	–90 –110	$25{\cdot}79+0{\cdot}22863t+0{\cdot}0_3416t^2$	
	0 –100	$28{\cdot}5+0{\cdot}29t$	Gerardin.
$CaCl_2$,	0 – 40	$48{\cdot}6+t+0{\cdot}01\dot{3}t^2$	
	41 – 59	$70+t$	
	60 –100	$66+1{\cdot}35t-0{\cdot}005t^2$	
$SrCl_2$,	0 –120	$44{\cdot}2+0{\cdot}3914t+0{\cdot}00186t^2$	
$BaCl_2$,	0 –105	$30{\cdot}62+0{\cdot}2711t$	Gay-Lussac.
	0 – 40	$30{\cdot}9+0{\cdot}235t+0{\cdot}0_325t^2$	
	41 – 80	$30{\cdot}9+0{\cdot}2213t+0{\cdot}0_36t^2$	
	81 –105	$30{\cdot}9+0{\cdot}2278t+0{\cdot}0_35125t^2$	
$CuCl_2$,		$41{\cdot}4+0{\cdot}105t$	Reicher and Deventer.
K_2PtCl_6,	0 –100	$0{\cdot}74+0{\cdot}0128t+0{\cdot}0_3316t^2$	
Cs_2PtCl_6,	0 –100	$0{\cdot}024+0{\cdot}00259t+0{\cdot}0_594t^2$	
NH_4Br,	0 –100	$57{\cdot}92+0{\cdot}855t-0{\cdot}0025t^2$	
$LiBr$,	0 – 82	$143+1{\cdot}79t-0{\cdot}0068t^2$	
$NaBr$,	above 44°	$110{\cdot}34+0{\cdot}1075t$	
	–25°– 0°	$79{\cdot}5+0{\cdot}4t$	
	0 –100	$79{\cdot}5+0{\cdot}414t+0{\cdot}00632t^2$	
KBr,	0 –110	$54{\cdot}43+0{\cdot}5128t$	Coppet.
KI,	–23 –114	$126{\cdot}23+0{\cdot}8088t$	,,
	0 –117	$128+0{\cdot}818t$	
NH_4NO_3,	0 – 70	$97+3{\cdot}9869t+0{\cdot}01976t^2+0{\cdot}0_3155t^3$	
$NaNO_3$,	0 –100	$73{\cdot}9+0{\cdot}479t+0{\cdot}0056t^2$	
	0 – 68	$67{\cdot}5+0{\cdot}87t$	Mendelejeff.
KNO_3,	0 –100	$13{\cdot}3+0{\cdot}607t+0{\cdot}0173t^2$	
	0 –100	$13{\cdot}3+0{\cdot}574t+0{\cdot}01717t^2+0{\cdot}0_536t^2$	,,
$AgNO_3$,	0 –100	$122+7t$	
$Sr(NO_3)_2$,	0 –31°·3	$39{\cdot}5+1{\cdot}50\dot{3}t+0{\cdot}00\dot{3}t^2$	
	31°·3–100°	$87{\cdot}4\dot{3}+0{\cdot}07t+0{\cdot}0_36t^2$	
$Ba(NO_3)_2$,	0 –102	$5+0{\cdot}186t+0{\cdot}00112t^2$	
$Pb(NO_3)_2$,	0 – 23	$36{\cdot}5+0{\cdot}79t$	
	24 – 44	$36{\cdot}5+0{\cdot}83t$	
	45 –105	$36{\cdot}5+0{\cdot}908t$	
$(NH_4)_2SO_4$	0 –109	$76{\cdot}4+0{\cdot}230\dot{3}t+0{\cdot}0_39\dot{6}t^2$	
Li_2SO_4,	0 –100	$35{\cdot}34-0{\cdot}045t-0{\cdot}0_337t^2$	
K_2SO_4,	0 – 50	$8{\cdot}5+0{\cdot}102t+0{\cdot}0_388t^2$	
	50 – 90	$15{\cdot}8+0{\cdot}2(t-50)$	
	0 –101	$8{\cdot}36+0{\cdot}1741t$	Gay-Lussac.
$MgSO_4$,	0 –108	$26{\cdot}9+0{\cdot}469t$	

TABLE LXXIIH. (2)—*continued.*

Substance.	Range of Temp.	S	Authority.
$MnSO_4$,	0°– 40°	$55\cdot4+0\cdot5675t+0\cdot0_2 1875t^2-0\cdot0_3 175t^3+0\cdot0_5 125t_4$	
	40 – 54	$73\cdot1+0\cdot158(t-40)$	
	64 – 83	$61\cdot5$ constant	
$FeSO_4$,	0°–63°·5	$7\cdot9+0\cdot8127t+0\cdot001436t^2$	
$CoSO_4$,	0°–106°	$24\cdot48+0\cdot48t+0\cdot001t^2$	
$NiSO_4$,	0 –108	$29\cdot24+0\cdot468t+0\cdot0_3 765t^2$	
$CuSO_4$,	0 –104	$16+0\cdot125t+0\cdot0045t^2$	
$ZnSO_4$,	0 – 39	$44+0\cdot6t+0\cdot0026t^2$	
$NaHCO_3$,	0 – 60	$6\cdot90+0\cdot121\dot{6}t+0\cdot0_3 6t^2$	
$KHCO_3$,	0 – 70	$19\cdot60+0\cdot3\dot{6}t$	
$KClO_3$,	0 – 35	$3\cdot2+0\cdot109t+0\cdot0043t^2$	Blarez.
K_2CrO_4,	0 –100	$58\cdot90+0\cdot202t$	
$(NH_4)_2C_2O_4$,	20 –100	$6\cdot616-0\cdot10155t+0\cdot003787t^2$	Claessen.
H_3BO_3,	0 –100	$1\cdot94+0\cdot063636t+0\cdot0016608t^2-0\cdot0_5 1604t^3$	Ditte.
$C_4H_6O_4$ (Succinic acid),	0°·5–75°·5	$2\cdot83+0\cdot1583091t+0\cdot0_3 37263t^2+0\cdot0_3 10541t_3$	Miczynski.
$Ca(HCOO)_2$,	0°– 80°	$16\cdot29784+0\cdot03229(t-0\cdot8)-0\cdot0_3 1254(t-0\cdot8)^2$	Krasnicki.
$Ba(HCOO)_2$,	1 – 76	$27\cdot7744+0\cdot0236743(t-1)+0\cdot0_2 63622(t-1)^2$ $-0\cdot0_4 60122(t-1)^3$	,,
$Ag.CH_3COO$,	0 – 76	$0\cdot6964+0\cdot01202t+0\cdot0_3 133t^2$	
$Ca(CH_3COO)_2$,	1 – 80	$37\cdot8512+0\cdot2575(t-1)+0\cdot0_2 58845(t-1)^2$ $-0\cdot0_4 475576(t-1)^3$	,,
$Ba(CH_3COO)_2$,	0 – 80	$58\cdot473+0\cdot65067(t-0\cdot8)-0\cdot0_2 5431(t-0\cdot8)^2$	,,
$Ag.C_2H_5COO$,	0 – 79	$0\cdot5238+0\cdot0171938(t-0\cdot7)-0\cdot0_4 7646(t-0\cdot7)_2$ $+0\cdot0_5 12501(t-0\cdot7)^3$	Raupenstrauch.
$Ca(C_2H_5COO)_2$,	0 – 79	$41\cdot2986+0\cdot11196(t-0\cdot2)+0\cdot0_4 85065(t-0\cdot2)^2$ $+0\cdot0_5 117907(t-0\cdot2)^3$	Krasnicki.
$Ba(C_2H_5COO)_2$,	0 – 80	$48\cdot2071+0\cdot371205(t-0\cdot6)-0\cdot0_2 15587(t-0\cdot6)^2$	,,
AgC_3H_7COO (*n*),	0 – 66	$0\cdot366+0\cdot0_2 51572(t-0\cdot6)+0\cdot0_4 498771(t-0\cdot6)^2$	Raupenstrauch.
AgC_3H_7COO (*i*),	0 – 78	$0\cdot8008+0\cdot0_2 757805(t-0\cdot6)+0\cdot0_4 20289(t-0\cdot6)^2$ $+0\cdot0_6 734379(t-0\cdot6)^3$	,,
$Ca(C_3H_7COO)_2$ (*i*),	1 – 80	$20\cdot383+0\cdot080609(t-1)+0\cdot0_3 65217(t-1)^2$	Sedlitzky.
AgC_4H_9COO (*n*),		$0\cdot2294+0\cdot002668(t-0\cdot3)+0\cdot0_4 7543(t-0\cdot3)^2$	,,
$Ag(CH_3)_2CHCH_2COO$,	0 – 80	$0\cdot1774+0\cdot003349(t-0\cdot2)+0\ 0_5 6528(t-0\cdot2)^2$	,,
$AgCH_3CH_2CH(CH_3)COO$,	1 – 80	$1\cdot1116-0\cdot0_3 2978(t-1)+0\ 0_3 2105(t-1)^2$	,,
$Ag(CH_3)_3C.COO$,		$1\cdot1038+0\cdot0_2 5131(t-1)+0\cdot0_4 4642(t-1)^2$	Stiassny.
$Ca(C_4H_9COO)_2$ (*n*),		$10\cdot238-0\cdot07643(t-0\cdot3)+0\cdot0_3 6293(t-0\cdot3)^2$	
$Ca\{(CH_3)_2CHCH_2COO\}_2$,	0 – 80	$18\cdot429+0\cdot105138(t-0\cdot2)-0\cdot0_2 10907(t-0\cdot2)^2$	,,
$Ca\{CH_3CH_2CH(CH_3)COO\}_2$,	0 – 80	$28\cdot9822+0\cdot33186(t-0\cdot6)-0\cdot0_2 4417(t-0\cdot6)^2$	,,
$Ba(C_4H_9COO)_2$ (*n*),		$21\cdot658-0\cdot12348(t-0\cdot3)+0\cdot001767(t-0\cdot3)^2$	
$AgC_5H_{11}COO$ (*n*),	0 – 70	$0\cdot07768+0\cdot0_3 8268t+0\ 0_4 31213t^2$	Keppich.
$Ag(C_2H_5)_2CHCOO$,	0 – 74	$0\cdot402+0\cdot0_3 847(t-0\cdot7)+0\cdot0_4 38(t-0\cdot7)^2$	,,
$AgCH_3CH_2.CH_2CH(CH_3)COO$,		$0\cdot51166+0\cdot0_2 172(t-1)+0\cdot0_4 1512(t-1)^2$	Sticht.
$Ca\{C_3H_7CH(CH_3)COO\}_2$,		$16\cdot4994-0\cdot08375(t-1)+0\cdot0_4 6424(t-1)^2$	,,
$Ca(C_5H_{11}COO)_2$ (*n*),	0 – 75	$2\cdot727-0\cdot01475(t-0\cdot7)+0\cdot0_3 2207(t-0\cdot7)^2$	,,
$Ca\{(C_2H_5)_2CHCOO\}_2$,	0 – 72	$30\cdot119-0\cdot2617(t-0\cdot7)+0\cdot0_2 1498(t-0\cdot7)^2$	,,
$Ba(C_5H_{11}COO)_2$ (*n*),	0 – 63	$9\cdot47-0\cdot08975(t-0\cdot5)+0\cdot0_2 14983(t-0\cdot5)^2$	,,

TABLE LXXIIH. (3).

In the following results obtained by Etard, S_t denotes the weight of the dissolved substance in 100 parts by weight of solution.

Substance.	Range of Temp.	S_t	Authority.
NaCl, ...	0°–100°	$26{\cdot}4+0{\cdot}0248t$	Etard.
KCl, ...	−90 –110	$20{\cdot}5+0{\cdot}1445(t+90)$	,,
$CaCl_2$, ...	−18 – 6	$32{\cdot}0+0{\cdot}2148(t+18)$	,,
	50 –120	$54{\cdot}5+0{\cdot}0755(t-50)$	,,
NaBr, ...	−20 – 40	$40{\cdot}0+0{\cdot}1746(t+20)$	,,
	50 –150	$52{\cdot}3+0{\cdot}0125(t-50)$	,,
KBr, ...	0 – 40	$34{\cdot}5+0{\cdot}2420t$	,,
	30 –120	$41{\cdot}5+0{\cdot}1378(t-30)$	,,
NaI, ...	0 – 80	$61{\cdot}3+0{\cdot}1712t$	,,
	80 –160	$75{\cdot}0+0{\cdot}0258(t-80)$	,,
KI, ...	0 –165	$55{\cdot}8+0{\cdot}1220t$	,,
$NaNO_3$, ...	−15 – 64	$36{\cdot}0+0{\cdot}2784(t+15)$	,,
	64 –313	$58{\cdot}0+0{\cdot}1686(t-64)$	,,
KNO_3, ...	10 – 69	$17{\cdot}0+0{\cdot}7118(t-10)$	,,
	69 –125	$59{\cdot}0+0\ 375(t-69)$	,,
	125 –338	$80{\cdot}0+0{\cdot}938(t-125)$	,,
$AgNO_3$, ...	55 –198	$81{\cdot}0+0{\cdot}1328(t-55)$	,,
$Ba(NO_3)^2$, ...	0 –210	$4{\cdot}5+0{\cdot}2000t$	,,
$KClO_3$, ...	0 – 42	$2{\cdot}6+0{\cdot}2000t$	,,
	42 –171	$11{\cdot}0+0{\cdot}3706(t-42)$	,,
	171 –350	$59{\cdot}0+0{\cdot}2186(t-171)$	,,
Li_2SO_4, ...	−20° –10°·5	$18{\cdot}5+0{\cdot}8421(t+20)$	,,
	−10°·5–100°	$26{\cdot}5-0{\cdot}0274(t+10{\cdot}5)$	,,
K_2SO_4, ...	0°–163°	$7{\cdot}5+0\ 1070t$	,,
	163 –220	25 constant	,,
Rb_2SO_4, ...	0 – 49	$26{\cdot}5+0{\cdot}2959t$	,,
	49 –170	$41{\cdot}0+0{\cdot}0661(t-49)$	,,
$MgSO_4$, ...	0 –123	$20{\cdot}5+0{\cdot}2276t$	,,
	123 –190	$48{\cdot}5-0{\cdot}4403(t-123)$	,,
$MnSO_4$, ...	−8 – 57	$30{\cdot}0+0{\cdot}2828(t+8)$	,,
	57 –150	$48{\cdot}0-0{\cdot}4585(t-57)$	,,
	at 161°	0	,,
$FeSO_4$, ...	−2°– 65°	$13{\cdot}5+0{\cdot}3788(t+2)$	,,
	65 – 98	37·5 constant	,,
	98 –156	$37{\cdot}5-0{\cdot}6685(t-98)$	,,
	at 156°	0	,,
$CuSO_4$, ...	−2°– 55°	$11{\cdot}6+0{\cdot}2614(t+2)$	,,
	55 –105	$26{\cdot}5+0{\cdot}3700(t-55)$	,,
	105 –190	$45{\cdot}0-0{\cdot}0293(t-105)$	,,
$ZnSO_4$, ...	−5 – 81	$27{\cdot}6+0{\cdot}2640(t+5)$	,,
	81 –175	$50{\cdot}0-0{\cdot}2244(t-81)$	,,
$CdSO_4$, ...	0 – 68	$35{\cdot}7+0{\cdot}2160t$	,,
	68 –200	$50{\cdot}6-0{\cdot}3681(t-68)$	,,
	at 215°	0	,,
$KHC_4H_4O_6$, ...	0°–100°	$0{\cdot}351+0{\cdot}0_2151t+0{\cdot}0_355t^2$	Babo & Portele.
	0 –100	$0{\cdot}369+0{\cdot}0_3569t^2$	Blarez.
SeO_2, ...	−3 – 36	$45{\cdot}0+0{\cdot}7692(t+3)$	Etard.
Cane sugar, ...	0 –100	$64{\cdot}1835+0{\cdot}13477t+0{\cdot}0_35307t^2$	Herzfeld.

In alcohol S_t = weight of salt in 100 parts alcohol.

NH_4Cl, ... 0°–56° $9{\cdot}80+0{\cdot}351t+0{\cdot}00024t^2$ (Sp. Gr. of Alcohol 0·939)

If c denote the weight of alcohol contained in 100 parts of an aqueous solution of alcohol, then the weight of $BaCl_2$ dissolved by 100 parts of such solution will be

$$30{\cdot}25-0{\cdot}7021c+0{\cdot}00479c^2-0{\cdot}0_583c^3.$$

TABLE LXXIIH. (4).

Nordenskjold gives :—

$$dS = bSdt, \text{ or } \frac{dS}{S} = bdt;$$

and therefore,

$$\text{Log}_e S_t = bt + a,$$

where a and b are constants. A more satisfactory form is

$$\text{Log}_e S_t = a + bt + ct^2.$$

The values of the constants are given as follows for the undermentioned salts :—

Substance.	a	b	c
NH_4Cl	− 0·5272	+ 0·5483	− 0·1732
$NaCl$	− 0·4484	+ 0·0105	+ 0·0319
KCl	− 0·5345	+ 0·3790	− 0·0900
$BaCl_2$	− 0·5084	+ 0·3413	− 0·0658
$NaNO_3$	− 0·1364	+ 0·3892	− 0·0030
KNO_3	− 0·8755	+ 0·2003	− 0·7717
$Ba(NO_3)_2$	− 1·2793	+ 1·2495	− 0·4307
$KClO_3$	− 1·4776	+ 1·7834	− 0·5555
K_2SO_4	− 1·1061	+ 0·8117	− 0·3245
K_2CrO_4	− 0·2219	+ 0·1741	− 0·0445

TABLE LXXIIIA.—**Solubility, etc., of Gases in Water 0°–100°.** (Winkler.)

	Hydrogen.		Nitrogen.		Oxygen.		Air.*	
	β.	β_1.	β.	β_1.	β.	β_1.	β.	β_1
0 °C.	0·02148	0·02135	0·02348	0·02334	0·04890	0·04860	0·02882	0·02864
1	02126	02112	02291	02276	04759	04728	02809	02791
2	02105	02090	02236	02220	04633	04601	02739	02720
3	02084	02068	02182	02166	04512	04479	02671	02652
4	02064	02047	02130	02113	04397	04362	02606	02585
5	02044	02026	02081	02063	04286	04250	02544	02522
6	02025	02006	02032	02013	04181	04142	02483	02460
7	02007	01987	01986	01966	04080	04040	02426	02401
8	01989	01968	01941	01920	03983	03941	02370	02344
9	01972	01950	01898	01877	03891	03847	02316	02291
10	01955	01932	01857	01834	03802	03756	02265	02238
11	01940	01915	01819	01795	03718	03670	02218	02189
12	01925	01899	01782	01758	03637	03587	02171	02142
13	01911	01883	01747	01722	03560	03507	02128	02097
14	01897	01867	01714	01687	03486	03431	02086	02053
15	01883	01851	01682	01654	03415	03358	02046	02012
16	01869	01836	01651	01622	03347	03288	02007	01972
17	01856	01821	01622	01591	03283	03220	01971	01933
18	01844	01806	01594	01562	03220	03155	01935	01896
19	01831	01792	01567	01534	03161	03093	01902	01861
20	01819	01777	01542	01507	03102	03031	01870	01827
21	01805	01761	01519	01482	03044	02970	01839	01794
22	01792	01746	01496	01457	02988	02911	01809	01762
23	01779	01730	01473	01433	02934	02853	01780	01731
24	01766	01715	01452	01410	02881	02797	01752	01701
25	01754	01700	01432	01387	02831	02743	01726	01672
26	01742	01685	01411	01365	02783	02691	01699	01643
27	01731	01670	01392	01344	02736	02641	01674	01616
28	01720	01656	01374	01323	02691	02592	01651	01589
29	01709	01642	01356	01303	02649	02545	01628	01564
30	01699	01630	01340	01284	02608	02500	01606	01539
31	01692	01618	01321	01263	02572	02459	01584	01514
32	01685	01606	01304	01243	02537	02419	01563	01490
33	01679	01596	01287	01224	02503	02380	01542	01467
34	01672	01585	01270	01204	02471	02342	01522	01443
35	01666	01574	01254	01185	02440	02306	01503	01420

* Calculated from nitrogen and oxygen.

TABLE LXXIIIA.—*continued.*

	Hydrogen.		Nitrogen.		Oxygen.		Air.*	
	β.	β1.	β.	β1.	β.	β1.	β.	β1.
36°	0·01661	0·01564	0·01239	0·01167	0·02410	0·02270	0·01485	0·01398
37	01657	01554	01224	01149	02382	02236	01467	01377
38	01652	01544	01210	01131	02355	02203	01450	01356
39	01648	01535	01196	01114	02330	02171	01434	01336
40	01644	01525	01183	01097	02306	02140	01419	01316
41	01640	01515	01171	01082	02280	02107	01404	01297
42	01635	01504	01160	01067	02256	02075	01390	01279
43	01631	01493	01149	01052	02232	02043	01376	01260
44	01627	01482	01139	01037	02209	02012	01354	01242
45	01624	01475	01129	01023	02187	01981	01351	01224
46	01620	01460	01120	01009	02166	01952	01340	01207
47	01617	01449	01111	00995	02145	01922	01328	01190
48	01614	01437	01102	00982	02126	01894	01317	01173
49	01611	01425	01094	00968	02108	01865	01307	01156
50	01608	01413	01087	00955	02090	01837	01298	01140
51	01607	01402	01079	00942	02073	01810	01288	01124
52	01606	01392	01072	00929	02057	01782	01279	01108
53	01606	01381	01065	00916	02041	01755	01270	01092
54	01605	01369	01058	00902	02026	01728	01261	01075
55	01604	01356	01051	00889	02012	01701	01253	01059
56	01603	01343	01045	00876	01998	01674	01245	01043
57	01602	01329	01039	00862	01984	01646	01237	01027
58	01602	01316	01033	00849	01971	01619	01230	01011
59	01601	01302	01027	00835	01958	01592	01222	00994
60	01600	01287	01022	00822	01946	01565	01216	00978
61	,,	01272	01016	00808	01933	01536	01209	00961
62	,,	01256	01011	00794	01921	01508	01202	00944
63	,,	01240	01006	00780	01909	01479	01196	00927
64	,,	01223	00901	00765	01897	01450	01189	00909
65	,,	01206	00996	00751	01885	01421	01183	00892
66	,,	01188	00992	00736	01874	01392	01177	00874
67	,,	01169	00987	00722	01863	01362	01171	00856
68	,,	01150	00983	00707	01853	01332	01166	00838
69	,,	01130	00980	00692	01843	01301	01161	00820
70	,,	01109	00976	00676	01833	01270	01156	00801

* Calculated from nitrogen and oxygen.

TABLE LXXIIIa.—*continued.*

	Hydrogen.		Nitrogen.		Oxygen.		Air.*	
	β.	β_1.	β.	β_1.	β.	β_1.	β.	β_1.
71°	0·01600	0·01087	0·00973	0·00661	0·01824	0·01239	0·01152	0·00782
72	,,	01065	00970	00645	01815	01208	01147	00763
73	,,	01041	00968	00630	01807	01176	01144	00745
74	,,	01017	00965	00614	01799	01144	01140	00725
75	,,	00992	00963	00597	01792	01111	01137	00705
76	,,	00966	00961	00581	01785	01078	01134	00685
77	,,	00939	00960	00564	01778	01044	01132	00665
78	,,	00912	00959	00546	01772	01010	01130	00643
79	,,	00883	00958	00528	01766	00975	01128	00622
80	,,	00853	00957	00510	01761	00939	01126	00600
81	,,	00822	00956	00491	01756	00902	01124	00577
82	,,	00790	00956	00472	01752	00865	01123	00555
83	,,	00757	00955	00452	01748	00827	01122	00531
84	,,	00723	00955	00432	01743	00788	01120	00507
85	,,	00688	00954	00410	01739	00748	01119	00481
86	,,	00652	00954	00388	01736	00707	01118	00455
87	,,	00614	00953	00366	01732	00665	01117	00429
88	,,	00575	00953	00343	01729	00622	01116	00402
89	,,	00535	00952	00318	01726	00577	01115	00372
90	,,	00494	00952	00294	01723	00532	01114	00344
91	,,	00451	00951	00268	01720	00485	01113	00314
92	,,	00407	00951	00242	01717	00437	01112	00283
93	,,	00361	00950	00215	01715	00387	01111	00251
94	,,	00315	00950	00187	01712	00337	01110	00219
95	,,	00266	00949	00158	01710	00284	01109	00184
96	,,	00216	00949	00128	01708	00231	01108	00150
97	,,	00164	00949	00098	01706	00175	01108	00114
98	,,	00111	00948	00066	01704	00119	01107	00077
99	,,	00056	00948	00034	01702	00060	01106	00039
100	,,	00000	00947	00000	01700	00000	01105	00000

β = Absorption coefficient = volume of gas (reduced to st. temp. and pressure) absorbed by 1 litre of water when pressure of gas outside liquid is 760 mm.

β_1 = Solubility of gas = volume of gas (corrected as above) absorbed by 1 litre when total pressure is 760 mm. $\beta=\beta\frac{760-p}{760}$; p = tension of aqueous vapour at t.

* Calculated from nitrogen and oxygen.

TABLE LXXIIIB.—Coefficients of Absorption of Gases in Water.

i.e., the volume of gas corrected to 0° C. and 760 mms. pressure absorbed by each unit volume of water at temperatures between 0° and 40° C., the pressure of the dry gas outside the water during absorption being 760 mms.

Temp. C.	Hydrogen.				Nitrogen.						Oxygen.					Chlorine.	Air.
	Bunsen.	Bohr & Bock.	Timofejeff.	Winkler.	Bunsen.	Hufner.	Bohr & Bock.	Dittmar.	Hamberg.	Winkler.	Bunsen.	Hufner.	Bohr & Bock.	Dittmar.	Winkler.	Schonfeld.	Bunsen.
0°	0·0193	0·0203	0·02153	0·02148	0·02035		0·02388	0·02440	0·02421	0·02348	0·04114		0·04961	0·04903	0·04890		0·02471
1	0193	0202	02134	02126	01981		02337	02374	02362	02291	04007		04838	04773	04759		02406
2	0193	0200	02115	02105	01932		02288	02314	02304	02236	03907		04720	04648	04633		02345
3	0193	0199	02097	02084	01884		02241	02259	02248	02182	03810		04606	04528	04512		02287
4	0193	0198	02079	02064	01838		02196	02209	02194	02130	03717		04496	04413	04397		02237
5	0193	0196	02061	02044	01794		02153	02162	02142	02081	03628		04389	04303	04286		02179
6	0193	0195	02044	02025	01752		02111	02116	02092	02032	03544		04286	04198	04181		02128
7	0193	0194	02027	02007	01713		02070	02071	02044	01986	03465		04186	04098	04080		02080
8	0193	0192	02010	01989	01675		02031	02027	01999	01941	03389		04089	04003	03983		02034
9	0193	0191	01994	01972	01640		01993	01984	01956	01898	03317		03994	03913	03891		01992
10	0193	0190	01978	01955	01607		01956	01943	01915	01857	03250		03903	03828	03802	2·5852	01953
11	0193	0189	01962	01940	01577		01920	01904	01876	01819	03189		03816	03747	03718	5413	01916
12	0193	0187	01947	01925	01549		01885	01867	01839	01782	03133		03732	03669	03637	4977	01882
13	0193	0186	01932	01911	01523		01851	01832	01804	01747	03082		03651	03593	03560	4543	01851
14	0193	0184	01918	01897	01500		01818	01798	01770	01714	03034		03573	03518	03486	4111	01822
15	0193	0183	01903	01883	01478		01786	01765	01737	01682	02989		03497	03444	03415	3681	01795
16	0193	0182	01889	01869	01458		01755	01733	01706	01651	02949		03425	03373	03347	3253	01771
17	0193	0180	01876	01856	01441		01725	01703	01677	01622	02914		03357	03306	03283	2828	01750
18	0193	0179	01863	01844	01426		01696	01674	01649	01594	02884		03292	03243	03220	2405	01732
19	0193	0178	01850	01831	01413		01667	01646	01623	01567	02858		03230	03183	03161	1984	01717
20	0193	0177	01837	01819	01403	0·01406	01639	01619	01598	01542	02838	0·02844	03171	03125	03102	1565	01701
21	0193	0175	01825	01805		01396	01611	01593	01575	01519		02825	03114	03069	03044	1148	
22	0193	0174	01813	01792		01386	01584	01567	01553	01496		02806	03059	03014	02988	0734	
23	0193	0172	01802	01779		01377	01557	01542	01532	01473		02786	03006	02960	02934	0322	
24	0193	0171	01791	01766		01367	01530	01517	01513	01452		02766	02956	02908	02881	1·9912	
25		0170	01780	01754		01357	01504	01493	01494	01432		02745	02904	02857	02831	9504	
26		0168	01770	01742		01347	01478	01470		01411		02724	02855	02808	02783	9099	
27		0167		01731		01337	01453	01448		01392		02702	02808	02761	02736	8695	
28		0166		01720		01328	01428	01427		01374		02680	02762	02716	02691	8295	
29		0164		01709		01318	01404	01408		01356		02658	02718	02672	02649	7895	
30		0163		01699		01308	01380	01390		01340		02635	02676	02629	02608	7499	
31		0162		01692		01298	01357	01370		01321			02635		02572	7104	
32		0161		01685		01288	01334	01350		01304			02596		02537	6712	
33		0160		01679		01279	01312	01330		01287			02558		02503	6322	
34		0159		01672		01269	01291	01310		01270			02521		02471	5934	
35		0157		01666		01259	01271	01290		01254		02546	02486	02432	02440	5550	
36		0156		01661			01252			01239			02452		02410	5166	
37		0155		01657			01233			01224			02419		02382	4785	
38		0154		01652			01215			01210			02387		02355	4406	
39		0153		01648			01198			01196			02356		02330	4029	
40		0152		01644		01210	01182	01220		01183		02447	02326	02260	02306	3655	

TABLE LXXIIIb.—*continued.*

Temp. C.	Carbon Monoxide, CO.			Carbon Dioxide, CO_2.	Ammonia, NH_3.			Nitrous Oxide, N_2O.	Nitric Oxide, NO.	Hydrogen Sulphide, H_2S.	Sulphur Dioxide, SO_2.	Hydrogen Chloride, HCl.	Marsh Gas, CH_4.	Ethylene, C_2H_4.	Propylene, C_3H_6.
	Bunsen.	Winkler.	Hinrichs *	Bunsen.	Carius.	Raoult.	Roscoe & Dittmar.	Carius.	Winkler.	Schonfeld.	Schönfeld.	Deicke.	Hinrichs.*	Bunsen.	v. Than.
0°	0·03287	0·03537	0·033071	1·7967	1049·60	1299·6	1158·08	1·3052	0·07381	4·3706	79·789	525·2	0·05473	0·2563	0·4465
1	03207	03450	032182	7207	1020·78	1213·3		2605	07171	2874	77·210		05315	2473	4249
2	03131	03369	031348	6481	993·26	1144·8	1102·49	2172	06981	2053	74·691		05232	2388	4045
3	03057	03292	030566	5787	966·98	1092·2		1752	06801	1243	72·230		05116	2306	3841
4	02987	03219	029834	5126	941·88	1053·5	1048·23	1346	06628	0442	69·828	494·7	05002	2227	3669
5	02920	03149	029150	4497	917·90	1025·2		0954	06461	3·9652	67·485		04890	2153	3493
6	02857	03081	028512	3901	894·99	1000·1	993·96	0575	06300	8872	65·200		04780	2082	3344
7	02796	03014	027918	3339	873·09	979·8		0210	06144	8103	62·973		04673	2018	3183
8	02739	02948	027367	2809	852·14	955·0	943·67	0·9858	05994	7345	60·805	480·3	04568	1952	3044
9	02686	02882	026855	2311	831·96	918·0		9520	05849	6596	58·697		04466	1893	2915
10	02635	02816	026381	1847	812·76	867·7	898·67	9196	05709	5858	56·647		04366	1837	2796
11	02588	02752	025943	1416	794·32	799·0		8885	05575	5132	54·655		04269	1786	2689
12	02544	02694	025539	1018	776·60	787·6	853·67	8588	05453	4415	52·723	471·3	04173	1737	2592
13	02504	02640	025167	0653	759·55	786·4		8304	05343	3708	50·849		04081	1693	2505
14	02466	02590	024824	0321	743·11	785·5	809·99	8034	05241	3012	49·033	462·4	03990	1652	2430
15	02432	02543	024509	0020	727·22	784·9		7778	05147	2326	47·276		03902	1615	2366
16	02402	02498	024220	0·9753	711·82	784·4	770·29	7535	05056	1651	45·578		03817	1583	2312
17	02374	02453	023954	9519	696·85	782·5		7306	04967	0986	43·939		03734	1553	2269
18	02350	02408	023710	9318	682·26	769·2	733·23	7090	04880	0331	42·360	451·2	03653	1528	2237
19	02329	02363	023485	9150	667·99	734·6		6888	04793	2·9687	40·838		03574	1506	2216
20	02312	02319	023278	9014	653·99	712·2	696·17	6700	04706	9053	39·374		03498	1488	2205
21		02276	023086		640·19			6525		8430	37·970		03425		
22		02237	022907		626·54		660·44	6364		7817	36·617		03354		
23		02202			612·98			6216		7215	35·302	435·0	03285		
24		02170			599·46		627·35	6082		6623	34·026		03218		
25		02141			585·94	635·6			04323	6091	32·786		03154		
26		02112					594·26			5470	31·584		03093		
27		02083								4909	30·422				
28		02054					563·82			4357	29·314				
29		02026								3819	28·210				
30		01998					533·38			3290	27·161				
31		01971								2771	26·151				
32		01946					505·58			2262	25·178				
33		01922								1764	24·244				
34		01900					479·12			1277	23·347				
35		01879								0799	22·489				
36							453·97			0332	21·668				
37										1·9876	20·886				
38							428·82			9430	20·141				
39										8994	19·435				
40		01775					406·32			8569	18·766				

TABLE LXXIIIc.—**Coefficients of Absorption of various Gases in Water.**

Gas.	Temperature.	β	Authority.
Air, ...	15° C.	0·05	de Saussure
	24·05	01748	Winkler
	0	024706	Bunsen
Ammonia, ...	0	1177·3	Sims
	0	1049·6	Carius
	0	1050	Bunsen
	0	1270	Berthelot
	0	1146	Roscoe and Dittmar
	0	1299·6	Raoult
	10	670	Davy
	15	450	Dumas
Carbon dioxide, . . .	0	1·7572	Rogers
	0	1·7967	Bunsen
	0	1·797	Wroblewski
	12·43	1·086	,,
	15·2	1·0121	Setschenow
	17	0·9519	,,
	17·1	0·9610	,,
	18·38	0·8960	,,
	19·3	0·8860	,,
	21	0·8380	,,
	23	0·7980	,,
	37·3	0·5690	,,
	37·29	0·5629	Bohr and Bock
	100	0·2438	,,
	39	0·5283	Luntz
	39·2	0·5215	,,
Carbon monoxide, . .	?	0·02	Davy
	0	0·032874	Bunsen
	0	0·03537	Winkler
Chlorine, ...	0	1·43	Gay-Lussac
	3	1·52	,,
	6·5	2·08	,,
	7	2·17	,,
	8	3·04	,,
	10	3·00	,,
	17	2·37	,,
	35	1·61	,,
	50	1·19	,,
	70	0·71	,,
	100	0·15	,,
	8	3·04	Pelouze and Fremy
	50	1·09	,,
	6·9	2·2931	Goodwin
	8·4	2·5469	,,
	9·3	2·7135	,,
	10·1	2·8741	,,

TABLE LXXIIIc.—*continued.*

Gas.	Temperature.	β	Authority.
Chlorine, ...	11·2° C.	2·7267	Goodwin
	13·7	2·5079	,,
	21·7	2·0422	,,
	32·1	1·5766	,,
	36·7	1·3802	,,
	0	3·0362	Schönfeld
Hydrogen, ...	0	0·0193	Bunsen
	0	0·2153	Timofejeff
	0	0·203	Bohr and Bock
	0	0·2148	Winkler
,, antimonide, . .	10·5	0·00412	Jones
,, arsenide, . .	?	0·2	Gmelin
,, bromide, . .	10	600 (about)	Berthelot
,, chloride, . .	ord. temp.	400 to 500	Dalton
	0	480	Davy
	0	480	Berzelius
	20	417·822	Thomson
	− 12	560	Berthelot
	0	500	,,
	+ 20	440	,,
	15	480	Hager
	0	525·2	Deicke
	4	494·7	,,
	8	480·3	,,
	12	471·3	,,
	14	462·4	,,
	18	451·2	,,
	18·25	450·7	,,
	23	435·0	,,
,, iodide, . . .	10	450	Thomson
	10	425	Berthelot
,, phosphide, (α) .		0·125	Davy
(α) .		0·1122	Dybkowsky
(β) .		0·018	Gengembre
(β) .		0·025	Davy
(β) .		0·0214	Henry
? .		0·255	Raymond
,, sulphide, . .	10	1·08	Henry
	11	3	Gay-Lussac and Thenard
	15	2·53	de Saussure
	ord. temp.	3·66	Thomson
	,,	2·5	Dalton
	0	4·3706	Schönfeld
Nitrogen, ...	15·5	0·0147	Henry
	ord. temp.	0·0156	Dalton
	0	0·020346	Bunsen
	0	0·02440	Dittmar

TABLE LXXIIIc.—*continued.*

Gas.	Temperature.	β	Authority.
Nitrogen,	0° C.	0·02421	Hamberg
	0	0·02388	Bohr and Bock
	0	0·02348	Winkler
Nitric oxide,	ord. temp.	0·1	Davy
	”	0·05	Henry
	”	0·037	Dalton
	0	0·07381	Winkler
Nitrous oxide,	ord. temp.	0·78	Henry
	”	0·80	Dalton
	0	1·03521	Bunsen
Oxygen,	ord. temp.	0·037	Pelouze and Fremy
	”	0·046	Otto-Graham
	0	0·04114	Bunsen
	0	0·04115	Bunsen and Pauli
	0	0·04903	Dittmar
	0	0·04961	Bohr and Bock
	0	0·04890	Winkler
	6·4	0·041408	Timofejeff
	12·6	0·036011	”
Ozone,	1 to 2·5	0·00511 } under low	Carius
	”	0·02816 } pressure.	”
	1	0·834	”
Sulphur dioxide,	18	30	Davy
	ord. temp.	20	Dalton
	”	43·78	de Saussure
	”	33	Thomson
	20	50	Pelouze and Fremy
	0	79·789	Schönfeld

TABLE LXXIIId.—Absorption of Gases by Water under various Pressures.

(1) Coefficients of Absorption of the Constituents of Dry Air.
(Calculated from the Data of Roscoe and Lunt, etc.)

t	Volume of Gas at 0° under 760 mms. Pressure absorbed by one Volume of Water.			Percentage of Oxygen.	Centimetre Cubes of N absorbed by 1 Litre (Hamberg).
	Nitrogen.	Oxygen.	Sum (N + O).		
0° C.	0·02238	0·00986	0·03224	30·58	19·14
1	02139	00963	03102	31·04	18·66
2	02048	00941	02989	31·49	18·20
3	01964	00920	02884	31·90	17·76
4	01887	00899	02786	32·27	17·34
5	01816	00879	02695	32·61	16·93
6	01751	00859	02610	32·91	16·54
7	01693	00840	02533	33·16	16·16

TABLE LXXIIID.—*continued.*

t	Volume of Gas at 0° under 760 mms. Pressure absorbed by one Volume of Water.			Percentage of Oxygen.	Centimetre Cubes of N absorbed by 1 Litre (Hamberg).
	Nitrogen.	Oxygen.	Sum (N+O).		
8° C.	0·01639	0·00822	0·02461	33·41	15·81
9	01591	00804	02395	33·57	15·47
10	01547	00787	02334	33·72	15·14
11	01507	00770	02277	33·81	14·83
12	01471	00754	02225	33·84	14·53
13	01439	00739	02178	33·92	14·25
14	01410	00724	02134	33·93	13·98
15	01383	00709	02092	33·90	13·72
16	01358	00695	02053	33·85	13·48
17	01336	00681	02017	33·76	13·25
18	01315	00668	01983	33·69	13·03
19	01295	00656	01951	33·62	12·82
20	01276	00644	01920	33·54	12·63
21	01257	00632	01889	33·46	12·45
22	01238	00621	01859	33·40	12·27
23	01219	00611	01830	33·39	12·10
24	01199	00601	01800	33·39	11·95
25	01178	00591	01769	33·40	11·81

(2) Number of Centimetre Cubes of Nitrogen absorbed from the Atmosphere by one Litre of Water under 760 mms. Pressure.

t	Pure Water.				Sea Water.		
	Bunsen.	Roscoe and Lunt.	Dittmar.	Hamberg.	Turnoe.	Dittmar.	Hamberg.
0° C.	16·09		19·29	19·14	14·40	15·60	14·85
5	14·18		17·09	16·93	13·25	13·86	13·32
10	12·70	15·47	15·36	15·14	12·10	12·47	12·06
15	11·67	13·83	13·95	13·73	10·95	11·34	11·04
20	11·08	12·76	12·80	12·63		10·41	10·25
25		11·78	11·81	11·80		9·62	9·62

(3) Centimetre Cubes of N and O absorbed from Atmosphere by one Litre of Water under 760 mms. Pressure. (Petterson and Sondén.)

t	C.cms. N.	C.cms. O.	Percentage O.
0° C.	19·53	10·01	33·88
6	16·34	8·28	33·60
6·32	16·60	8·39	33·35
9·18	15·58	7·90	33·60
13·70	14·16	7·14	33·51
14·10	14·16	7·05	33·24

.E LXXIIID.—*continued.*

y of Ammonia in Water. (Sims.)

At 20° C.		At 40° C.		At 100° C.	
g	G	*g*	G	*g*	G
119	1·513				
141	337	0·052	0·497		
158	200	064	490		
173	095	076	483		
187	017	088	476		
202	0·962	099	470		
207	918	109	462		
232	881	120	454		
266	810	145	440		
296	750	168	426		
325	705	191	414		
353	670	211	402		
378	638	232	399		
403	612	251	382		
425	587	269	372		
447	566	287	363		
470	550	304	355		
492	534	320	347	0·068	0·074
514	521	335	339	073	074
518	518	338	338	074	074
535	504	349	332	078	074
556	497	363	325	083	074
574	485	378	319	088	074
594	475	391	313	092	073
613	466	404	307	096	073
632	457	414	300	101	073
651	450	425	294	106	073
669	442	434	287	110	073
685	433	445	282	115	073
704	428	454	276	120	073
722	422	463	271	125	073
741	417	472	266	130	073
761	413	479	260	135	073
780	409	486	255		
801	406	493	250		
842	400	511	242		
881	394	530	237		
919	388	547	231		
955	382	565	226		
992	377	579	220		
		594	215		

. dissolved in 1 gramme of water at given pressure.
der pressure of 760 mms. that would be absorbed by 1 grm. of
portional to pressure

TABLE LXXIIID.—*continued.*

(5) Weight (w) of NH_3 absorbed by one Unit Weight of Water at 0° C. under pressure of P mms. (Roscoe and Dittmar.)

P.	w.	P.	w.	P.	w.	P.	w.	P.	w.	P.	w.
10	0·044	150	0·351	500	0·690	900	0·968	1300	1·310	1700	1·770
20	084	175	382	550	731	950	1·001	1350	361	1750	835
30	120	200	411	600	768	1000	037	1400	415	1800	906
40	149	250	465	650	804	1050	075	1450	469	1850	976
50	175	300	515	700	840	1100	117	1500	526	1900	2·046
75	228	350	561	750	872	1150	161	1550	584	1950	120
100	275	400	607	800	906	1200	208	1600	645	2000	125
125	315	450	646	850	937	1250	258	1650	707		

(6) Coefficient of Absorption of CO_2 in Water under various Pressures.

P.	t° C.	β.	Authority.
1 atmosphere	0° C.	1·797	Wroblewski.
5 "	"	8·65	"
10 "	"	16·03	"
15 "	"	21·95	"
20 "	"	26·65	"
25 "	"	30·55	"
30 "	"	33·74	"
1 "	12·43	1·086	"
5 "	"	5·15	"
10 "	"	9·65	"
15 "	"	13·63	"
20 "	"	17·11	"
25 "	"	20·31	"
30 "	"	23·35	"
697·71 mm.	0°	0·9441	Khanikoff and Longuinine.
809·03 "	"	1·1619	"
1289·41 "	"	1·8647	"
1469·95 "	"	2·1623	"
2002·06 "	"	2·9067	"
2188·65 "	"	3·1764	"
2369·02 "	"	3·4857	"
2554·00 "	"	3·7152	"
2738·33 "	"	4·0031	"
3109·51 "	"	4·5006	"
115·20 "	15·2	1·004	Setschenow.
448·35 "	"	1·016	"
563·67 "	"	1·010	"
654·33 "	"	1·008	"
718·28 "	"	1·012	"
718·50 "	"	1·009	"
721·10 "	"	1·011	"
804·90 "	"	1·007	"
814·40 "	"	1·009	"
866·10 "	"	1·013	"
874·50 "	"	1·000	"
875·20 "	"	1·008	"

under pressure of P mms. not 760.

TABLE LXXIIID.—*continued.*

(7) Absorption and Solubility of Chlorine Trioxide.

One vol. water absorbs 5·6 vols. Cl_2O_3 (Millon). At 8°·5 C. under 753 mms. 1 vol. water absorbs 8·591 vols. Cl_2O_3. (Brandan.)

100 grms. H_2O at 8°·5	under 752·9 mms.	dissolve 4·7655 grms. Cl_2O_3.	
„ 14	„ 756·3	„ 5·0117 „	
„ 21	„ 754	„ 5·4447 „	
„ 93	„ 760	„ 5·6508 „	(Brandan).

(8) Weight (w) of Hydrogen Bromide dissolved in the Unit Weight of Water. (Roozeboom.)

t° C.	P. in mms.	w.	t° C.	P. in mms.	w.
−25°	760	2·550	−15°	175	2·056
	300	2·263		102	1·980
	140	2·120	−11·3	760	2·350
	100	2·056		570	2·265
	1	1·755		310	2·118
	0·5	1·10		216	2·055
−20	760	2·473	−5	760	2·280
	375	2·267		730	2·264
	180	2·119		430	2·117
	130	2·056		298	2·055
	20	1·850	0	760	2·212
−15	760	2·390		540	2·116
	470	2·266		380	2·054
	250	2·119		5	1·085

(9) Solubility of HCl in Water at 0°. (Roscoe and Dittmar.)

w = Weight in grms. of the HCl absorbed by 1 grm. of water under pressure P.
P = Partial pressure, *i.e.* total pressure minus tension of aqueous vapour, or the pressure exerted by the dry gas.

P. in mms.	w.	P. in mms.	w.	P. in mms.	w.	P. in mms.	w.
60	0·613	140	0·681	350	0·751	750	0·824
70	628	150	686	400	763	800	831
80	640	175	697	450	772	900	844
90	649	200	707	500	782	1000	856
100	657	225	716	550	791	1100	869
110	664	250	724	600	800	1200	882
120	670	275	732	650	808	1300	895
130	676	300	738	700	817		

(10) Solubility of SO_2 in Water under various Pressures. (Sims.)

P = Partial pressure in mms.
w = Weight in grms. of SO_2, exerting pressure P, dissolved in 1 grm. weight of water.
W = Calculated weight of SO_2 absorbed under 760 mms. pressure if absorption were exactly proportional to pressure.
v = Volume of w grms. of SO_2 at 0° C. under pressure of 760 mms.
V = „ W „ „ „

TABLE LXXIIID.—*continued.*

P.	At 7° C.				At 20° C.				At 39°·8 C.				At 50° C.			
	w.	W.	*v.*	V.	*w.*	W.	*v.*	V.	*w.*	W.	*v.*	V.	*w.*	W.	*v.*	V.
30	0·010	0·263	3·634	92·06												
40	013	242	4·451	84·55	0·007	0·143	2·637	50·09								
50	015	223	5·129	77·95	009	138	3·171	48·20								
60	017	218	6·024	76·28	011	135	3·718	47·10								
70	020	213	6·868	74·55	012	131	4·205	45·64								
80	022	210	7·743	73·55	013	127	4·663	44·30								
90	025	208	8·598	72·62	015	125	5·169	43·65								
100	027	205	9·421	71·60	016	124	5·692	43·25								
120	032	201	11·09	70·20	019	121	6·683	42·33								
140	036	197	12·71	69·00	022	119	7·690	41·75								
160	041	195	14·34	68·15	025	118	8·666	41·17								
180	046	193	15·97	67·40	028	117	9·652	40·75								
200	050	191	17·59	66·83	030	116	10·62	40·35	0·016	0·062	5·675	21·57	0·012	0·045	4·156	15·97
220	055	190	19·19	66·30	033	115	11·59	40·03								
240	059	188	20·79	65·84	036	114	12·54	39·70								
260	064	187	22·40	65·44	038	112	13·45	39·30								
280	069	186	23·99	65·10	041	112	14·41	39·10								
300	073	185	25·59	64·81	044	111	15·34	38·87	024	061	8·368	21·20				
350	085	184	29·55	64·16	050	110	17·66	38·35								
400	096	182	33·51	63·65	059	109	20·[illegible]	38·10	031	060	11·03	20·95	024	045	8·275	15·72
450	107	181	37·44	63·25	064	108	22·37	37·77								
500	118	180	41·42	62·94	071	107	24·67	37·50	039	059	13·67	20·77				
550	130	179	45·31	62·60	077	106	26·93	37·20								
600	141	178	49·20	62·32	083	105	29·14	36·90	047	059	16·29	20·64	035	045	12·36	15·65
650	152	178	53·10	62·09	090	105	31·39	36·70								
700	163	177	56·98	61·86	096	105	33·62	36·50								
750	174	176	60·88	61·69	103	104	35·94	36·43								
760	176	176	61·65	61·65	104	104	36·43	36·43	059	059	20·50	20·50	045	045	15·62	15·62
800	185	175	64·74	61·50	110	104	38·32	36·40	062	059	21·58	20·50	047	045	16·43	15·60
850	196	175	68·57	61·30												
900	207	175	72·41	61·15												
950	218	175	76·25	61·00												
1000	229	174	80·01	60·88	137	104	47·85	36·37	077	058	26·84	20·40	059	045	20·51	15·59
1050	240	174	83·97	60·77												
1100	251	174	87·80	60·65												
1200	273	173	95·45	60·45												
1300	295	172	103·00	60·25	178	104	62·10	36·31								
1500									113	057	39·65	20·09	088	044	30·73	15·57
1600					218	104	76·35	36·27								
1900					259	104	90·53	36·21								
2000									149	057	52·11	19·80	112	044	39·07	15·55

TABLE LXXIIID.—*continued.*

(11) Weights of various Gases absorbed by 1 grm. of Water under 760 mm. Pressure.

t° C.	Ammonia.		Hydrogen Chloride.	Sulphur Dioxide.
	Roscoe and Dittmar.	Sims.	Roscoe and Dittmar.	Sims.
0°	0·875	0·899	0·825	
2	833	853	814	
4	792	809	804	
6	751	765	793	
8	713	724	783	0·168
10	679	684	772	154
12	645	646	762	142
14	612	611	752	130
16	582	578	742	121
18	554	546	731	112
20	526	518	721	104
22	499	490	710	098
24	474	467	700	092
26	449	446	691	087
28	426	426	682	083
30	403	408	673	078
32	382	393	665	073
34	362	378	657	069
36	343	363	649	065
38	324	350	641	062
40	307	338	633	058
42	290	326	626	055
44	275	315	618	053
46	259	304	611	050
48	244	294	603	047
50	229	284	596	045
52	214	274	589	
54	200	265	582	
56	186	256	575	
58		247	568	
60		238	561	
70		194		
80		154		
90		114		
98		082		
100		074		

TABLE LXXIIIE.—**Absorption of Gases in various Liquids and Solutions.**

(1) Solubility of Ammonia in absolute Alcohol under 760 mm. Pressure. (de Bruyn.)

$t°$ C.	Per cent. NH_3.	Wt. of NH_3 per 100 pts. H_2O.
0°	19·7	24·5
6	17·1	20·6
11·7	14·1	16·4
14·7	13·2	15·2
17	12·6	14·7
22	10·9	12·2
28·4	9·2	10·1

(2) Solubility of Ammonia in Alcohol. (Delépine.)

β = Coefficient of absorption.
w = Weight of NH_3 contained in 1 litre of solution saturated under 760 mms.
s = Specific gravity of solution.

$t°$ C.		Degrees of Alcohol.					
		100°.	90°.	80°.	70°.	60°.	50°.
0°	β	209·5	245·0	390·0		504·0	697·7
	w	130·5	146·0	206·5		246·0	304·5
	s	0·782	0·783	0·808		0·830	0·835
10	β	164·3	186·0	288·0		373·0	438·6
	w	108·5	120·0	167·0		198·25	227·0
	s	0·787	0·803	0·800		0·831	0·851
20	β	106·6	147·8	190·5	223·0	260·8	338·2
	w	75·0	97·5	119·75	137·5	152·5	182·7
	s	0·791	0·788	0·821	0·829	0·842	0·869
30	β	97·0	106·7	121·6		211·6	252·0
	w	51·5	74·0	81·75	100·3	129·5	152·0
	s	0·798	0·791	0·826		0·846	0·883

(3) Solubility of Ammonia in Alcohol. (Pagliani and Emo.)

$t°$ C.	P. in mms.	β.	$t°$ C.	P. in mms.	β.	$t°$ C.	P. in mms.	β.
20°·40	457·00	70·9	22°·10	467·35	70·6	23°·00	455·22	66·3
21 ·32	443·78	68·5	22 ·70	525·49	75·2	23 ·10	630·39	87·3
21 ·61	511·05	75·4	22 ·75	474·89	68·7	23 ·16	613·23	91·4
21 ·70	568·27	81·5	22 ·98	623·65	85·3	23 ·19	629·17	76·6
						24 ·60	634·36	84·4

TABLE LXXIII.—*continued.*

(4) Coefficients of Absorption of various Gases in Alcohol. B = Bunsen; C = Carius; T = Timofejeff.

t° C.	Carbon Dioxide (C).	Ethylene (C).	Hydrogen C).	Hydrogen Sulphide (C).	Methane (C).	Nitrogen (C).	Nitric Oxide (C).	Nitrous Oxide (C).	Oxygen (T). β	Oxygen (T). β_1	Sulphur Dioxide(B).
0°	4·3295	3·5950	0·06925	17·891	0·52259	0·12634	0·31606	4·1780	0·23370	0·22978	328·62
1	2368	5379	910	17·242	51973	593	31262	1088	296	878	311·98
2	1466	4823	896	16·606	51691	553	30928	0409	222	777	295·97
3	0589	4280	881	15·983	51412	514	30604	3·9741	149	675	280·58
4	3·9736	3750	867	15·373	51135	476	30290	9085	077	572	265·81
5	8908	3234	853	14·776	50861	440	29985	8442	005	469	251·67
6	8105	2732	839	14·193	50590	405	29690	7811	22934	365	238·16
7	7327	2243	826	13·623	50322	371	29405	7192	863	260	225·25
8	6573	1768	813	13·066	50057	338	29130	6585	793	155	212·98
9	5844	1307	799	12·523	49795	306	28865	5990	724	047	201·33
10	5140	0859	786	11·992	49535	276	28609	5408	656	21937	190·31
11	4461	0425	774	11·475	49278	247	28363	4838	588	827	179·91
12	3807	0005	761	10·971	49024	219	28127	4279	521	715	170·13
13	3178	2·9598	749	10·480	48773	192	27901	3734	455	601	160·98
14	2573	9205	737	10·003	48525	166	27685	3200	389	484	152·45
15	1993	8825	725	9·539	48280	142	27478	2678	324	365	144·55
16	1438	8459	713	9·088	48037	119	27281	2169	259	245	137·27
17	0908	8107	701	8·650	47798	097	27094	1672	195	122	130·61
18	0402	7768	690	8·225	47561	076	26917	1187	132	20994	124·58
19	2·9921	7443	679	7·814	47327	056	26750	0714	069	862	119·17
20	9465	7131	668	7·415	47096	038	26592	0253	007	733	114·48
21	9034	6833	657	7·030	46867	021	26444	2·9805	21946	600	110·22
22	8628	6549	646	6·659	46642	005	26306	9368	886	459	106·68
23	8247	6279	636	6·300	46419	11990	26178	8944	826	317	103·77
24	7890	6022	626	5·955	46199	976	26060	8532	767	172	101·47
25	7558	5778	616	5·623	45982	964	25951	8133			99·81

TABLE LXXIIIE.—*continued.*

(5) Solubility of Ammonia in Methyl Alcohol. (de Bruyn.)

$t°$ C.	Percentage of NH_3.	Parts NH_3 per 100 parts Alcohol.	$t°$ C.	Percentage of NH_3.	Parts NH_3 per 100 parts Alcohol.
0°	29·3	41·5	[illegible]	20·8	26·3
6	26·0	35·2	[illegible]	18·3	22·4
11·7	23·5	30·7	·4	14·8	17·4
14·7	21·8	27·9			

(6) Coefficient of Absorption of NH_3 in Propyl Alcohol. (Pagliani and Emo.)

$t°$ C.	P. in mms.	β.	$t°$ C.	P. in mms.	β.
19°·60	456·59	56·6	20°·90	588·08	67·5
19 ·80	484·36	59·2	20 ·96	576·00	66·4
19 ·90	525·54	62·7	21 ·20	706·00	76·8
20 ·43	453·82	55·3	21 ·36	722·88	78·3
20 ·62	416·97	50·9	21 ·74	464·83	53·4
20 ·62	498·77	59·6			

(7) Ammonia in Isobutyl Alcohol. (Pagliani and Emo.)

$t°$ C.	P. in mms.	β.	$t°$ C.	P. in mms.	β.
20°·18	523·11	59·1	21°·00	587·99	55·7
20 ·20	479·00	54·3	21 ·19	538·90	51·9
20 ·42	659·89	70·5	21 ·21	639·33	60·6
20 ·49	585·21	64·3	21 ·25	733·86	67·1
20 ·62	725·30	75·4			

(8) Absorption of Ammonia by various liquids. (Various.)

1 vol.	oil of lavender	at 20° C.	absorbs	47 vols	of NH_3
1 ,,	oil of lemon	,, 16	,,	8·3	,,
1 ,,	oil of rosemary	,, 29	,,	9·75	,,
1 ,,	oil of turpentine	,, 16	,,	7·5	,,
1 ,,	petroleum	,, 15	,,	2·4	,,

(9) Weight of NH_3 absorbed by 100 c.cms. of various Solutions. (Raoult.)

$t°$ C.	Solution containing				
	11·25 per cent. K_2O.	25·25 per cent. K_2O.	28·38 per cent. $Ca(NO_3)_2$.	59·03 per cent. $Ca(NO_3)_2$.	
0°	72·00	49·50	96·25	104·50	At 13° C.
8	57·00	37·50	78·50	84·75	100 c.cms. 74·1 per cent. NH_4NO_3 absorbed 63·75 grms. NH_3, and the same volume of 52·4 per cent. $NaNO_3$ absorbed 64·25.
16	46·00	28·50	65·00	70·50	
24	37·25	21·75			

TABLE LXXIIIE.—*continued.*

(10) Solubility of Carbon dioxide in various liquids.

1 vol. pure H_2SO_4	at 17° C. absorbs	0·932 vols. of CO_2.		(Setschenow.)
1 ,, $H_2SO_4 + 3/16\ H_2O$	,, ,, ,,	0·852 ,,		,,
1 ,, $H_2SO_4 + \frac{1}{2}H_2O$	,, ,, ,,	0·719 ,,		,,
1 ,, $H_2SO_4 + H_2O$	,, ,, ,,	0·666 ,,	(min.)	,,
1 ,, $H_2SO_4 + 2H_2O$	,, ,, ,,	0·705 ,,		,,
1 ,, $H_2SO_4 + 58H_2O$	,, ,, ,,	0·857 ,,		,,
1 ,, H_2SO_4	,, 15°·56 ,,	0·94 ,,		(Rogers.)
1 ,, fuming H_2SO_4	,, ,, ,,	1·25 ,,		,,

1 ,, 15 per cent. solution of NaCl absorbs about half as much as water.

(11) Solubility of Chlorine in Various Liquids and Solutions.

1 litre 38 per cent. solution of HCl dissolves 7·3 grms. of chlorine. (Berthelot.)

,, 12 ,, ,, ,, ,,		11·0 ,,	,,	,,
,, 3 ,, ,, ,, ,,		6·5 ,,	,,	,,
,, 9·97 ,, ,,	NaCl absorbs at	7·9° C.	1·8115 l. of Cl_2.	(Kumpf.)
,, ,, ,, ,,	,, ,,	11·9 ,,	1·5879 ,, ,,	,,
,, ,, ,, ,,	,, ,,	15·4 ,,	1·3684 ,, ,,	,,
,, ,, ,, ,,	,, ,,	18·8 ,,	1·2785 ,, ,,	,,
,, ,, ,, ,,	,, ,,	22·6 ,,	1·0081 ,, ,,	,,
,, 16·01 ,, ,,	,, ,,	6·0 ,,	1·5866 ,, ,,	,,
,, ,, ,, ,,	,, ,,	11·6 ,,	1·2227 ,, ,,	,,
,, ,, ,, ,,	,, ,,	16·4 ,,	1·0121 ,, ,,	,,
,, ,, ,, ,,	,, ,,	21·4 ,,	0·8732 ,, ,,	,,
,, ,, ,, ,,	,, ,,	26·9 ,,	0·7017 ,, ,,	,,
,, 19·66 ,, ,,	,, ,,	0 ,,	1·6978 ,, ,,	,,
,, ,, ,, ,,	,, ,,	9·2 ,,	1·2145 ,, ,,	,,
,, ,, ,, ,,	,, ,,	9·3 ,,	1·2068 ,, ,,	,,
,, ,, ,, ,,	,, ,,	14·8 ,,	0·9740 ,, ,,	,,
,, ,, ,, ,,	,, ,,	15·4 ,,	0·9511 ,, ,,	,,
,, ,, ,, ,,	,, ,,	20·4 ,,	0·7758 ,, ,,	,,
,, ,, ,, ,,	,, ,,	21·9 ,,	0·7385 ,, ,,	,,

Saturated solution of KCl at 15° C. absorbs $\frac{1}{3}$ less Cl_2 than pure H_2O.

1 litre aqueous solution of $CaCl_2$ (1 in 15) at 12° C. dissolves 2·45 grms. Cl_2.

,, ,, $MgCl_2$ (1 in 15) ,, ,, 2·33 ,,

,, ,, $MnCl_2$ (1 in 15) ,, ,, 2·00 ,,

100 grms. $CrOCl_2$ at	0° C. absorb	17·853	grms. of Cl_2.	(Roozeboom.)
,, ,,	−14 ,, ,,	31·624	,, ,,	,,
,, ,,	−21 ,, ,,	58·913	,, ,,	,,
,, ,,	−24 ,, ,,	76·511	,, ,,	,,

Sulphuryl chloride at 0° C. absorbs 71 vols. of Cl_2. (Schulze.)

(12) Solubility of Hydrogen and other Gases in various Liquids.

1 vol. of petroleum	absorbs at 10° C.	0·0652	vol. of hydrogen.	
,, ,,	,, 20 ,,	0·0582	,, ,,	
,, alcohol	,,	0·85	,, PH_3.	(Graham.)
,, ether	,,	2·00	vols. of PH_3.	,,

TABLE LXXIIIE.—*continued.*

1 vol. of oil of turpentine absorbs at 10° C. 3·25 vols. of PH_3. (Graham.)
„ alcohol at 0° C. „ „ 0·126338 vol. of N_2. (Carius.)
„ petroleum „ 10 „ „ „ 0·135 „ „ (Gineswasz and Walfisz.)
„ „ „ 20 „ „ „ 0·117 „ „ „ „
„ „ „ 10 „ „ „ 2·49 „ N_2O „ „
„ „ „ 20 „ „ „ 2·17 „ „ „ „

100 vols. of concentrated solution of $FeSO_4$ absorb 19·5 vols. of N_2O. (Lunge.)
„ 7 per cent. NaOH solution „ 23·1 „ „ „
„ „ „ saturated with pyrogallol „ 28 „ „ „
„ KOH solution (sp. gr. = 1·12) „ 18·7 „ „ „
„ „ „ saturated with pyrogallol „ 18·1 „ „ „
„ H_2SO_4 (sp. gr. = 1·84) „ 75·7 „ „ „
„ „ („ = 1·80) „ 66·0 „ „ „
„ „ („ = 1·705) „ 39·1 „ „ „
„ „ („ = 1·45) „ 41·6 „ „ „
„ „ („ = 1·25) „ 33·0 „ „ „
„ „ („ = 1·84) „ 3·5 „ NO „
„ „ („ = 1·50) „ 1·7 „ „ „
„ HNO_3 („ = 1·3) „ 20 „ „ (Dalton.)
„ $FeSO_4$ solution (1 grm. $FeSO_4$ to 6 grms. H_2O) „ 600 „ „ „

Between 0° C. and 10° C. ferrous solutions absorb 2 mols. NO for every atom of Fe.
Between 10° C. and 15° C. ferrous solutions absorb 1 mol. for 2 atoms of Fe.
At 100° all NO is expelled.
} Irrespective of concentration. (Gay.)

1 vol. of alcohol at all temperatures between 0° C. and 24° C. absorbs 0·28397 vols. of O_2. (Bunsen.)
1 vol. of alcohol absorbs from 12 to 13 vols. of propylene. (v. Than.)
„ „ at 18° absorbs 6 vols. of acetylene. (Berthelot.)

1 litre H_2SO_4 (sp. gr. = 1·841) at 0° C. absorbs 5·8 litres or 16·59 grms. SO_2. (Kolbe.)
„ „ („ = 1·839) „ „ „ 8·9 „ 25·47 „ „ „
„ „ („ = 1·540) „ „ „ 11·2 „ 32·05 „ „ „
„ „ („ = 1·407) „ „ „ 15·9 „ 45·49 „ „ „
„ „ („ = 1·227) „ „ „ 29·7 „ 84·98 „ „ „
„ „ („ = 1·020) „ „ „ 49·0 „ 140·21 „ „ „
„ „ („ = 1·841) „ 17° C. „ 28·14 „ „ (Dunn.)
„ „ („ „) „ 16 „ 28·86 „ „ „
„ „ („ „) „ 5·8 „ „ (Lunge.)
„ „ („ = 1·839) „ 8·9 „ „ „
„ „ Com. „ 200 „ of propylene. (v. Than.)

100 parts of absolute methyl alcohol at 0° C. and 760 mms. absorb 247 parts SO_2. (de Bruyn.)
„ „ „ „ 26 „ „ 47 „ „
„ „ ethyl „ 0 „ „ 115 „ „
„ „ „ „ 26 „ „ 32·3 „ „

Camphor at 0° C. and 725 mm absorbs 0·880 times its weight or 308 times its vol. of SO_2.
Glacial acetic acid „ „ „ 0·961 „ „ 318 „ „ „
Formic acid „ „ „ 0·821 „ „ 351 „ „ „
Acetone „ „ „ 2·07 „ „ 589 „ „ „
Sulphuryl chloride „ „ „ 0·323 „ „ 187 „ „ „
(Schultze.)

TABLE LXXIIIF.—Formulæ, etc., referring to the Absorption of Gases.

Henry's Law.—"*The mass of gas absorbed by a specified mass of a liquid varies directly as the pressure exerted by the gas*"; or "*A given mass of a liquid absorbs, under all pressures, the same volume of a gas.*"

β = Coefficient of absorption of a gas.
v = Volume in cm.^{3} of gas absorbed by V cm.^{3} of liquid at temperature $t°$ C.
α = Coefficient of gaseous expansion.

$$\beta = \frac{v}{V(1+\alpha t)}.$$

$$\beta_t = \beta_0 + at + bt^2 + ct^3.$$

If by τ we denote any other temperature, we may write

$$\beta_t = \beta_\tau + a(t-\tau) + b(t-\tau)^2 + c(t-\tau)^3,$$

where, of course, the values of a, b, and c are different from the corresponding values in the preceding equation.

TABLE LXXIIIF.

Gas.	Solvent.	Range of Temperature.	β.	a.	b.	c.	Authority.
Air, . . .	Water	0° C. to 20° C.	+ 0·024706	− $0{\cdot}0_{3}6544$	+ $0{\cdot}0_{4}13547$		Bunsen
Ammonia, . .	Water	0 „ 25	1049·624	29·4963	0·676874	− $0{\cdot}0_{2}95621$	Carius
Butane, . . .	Water	0 „ 20	0·031474	$0{\cdot}0_{2}10449$	$0{\cdot}0_{4}25066$		Bunsen
	Water	5·8 „ 21·8	0·030827	$0{\cdot}0_{3}92585$	$0{\cdot}0_{4}20384$		Hinrichs
Carbon dioxide, .	Water	0 „ 20	1·7967	0·07761	$0{\cdot}0_{2}16424$		Bunsen
	Water	17 „ 27	1·5062	0·036511	$0{\cdot}0_{3}2917$		Naccari and Pagliani
	Water	4·4 „ 22·4	1·7326	0·066724	$0{\cdot}0_{2}12394$		Hinrichs
	Alcohol	0·2 „ 24	4·32955	0·09395	$0{\cdot}0_{2}124$		Carius
	Alcohol	3·2 „ 22·6	4·3294	0·094261	$0{\cdot}0_{2}12354$		Hinrichs
Carbon monoxide, .	Water	0 „ 20	0·032874	$0{\cdot}0_{3}81632$	$0{\cdot}0_{4}16421$		Bunsen
	Water	5·8 „ 22	0·032784	$0{\cdot}0_{3}80094$	$0{\cdot}0_{4}15872$		Hinrichs
Chlorine, . .	Water	0 „ 40	3·0361	0·046196	$0{\cdot}0_{3}1107$		Schönfeld
	9·97% NaCl	7·9 „ 22·6	2·2317	0·05505	$0{\cdot}0_{4}25$		Kumpf
	16·01 „ „	6 „ 26·9	2·1923	0·11281	$0{\cdot}0_{2}32806$	$0{\cdot}0_{4}4218$	„
	19·66 „ „	0 „ 21·9	1·7440	0·06717	$0{\cdot}0_{2}117$	$0{\cdot}0_{5}97$	„
Ethane, . . .	Water	0 „ 20	0·094556	$0{\cdot}0_{2}35324$	$0{\cdot}0_{4}6278$		Schickendantz
	Water	2 „ 21·5	0·0939012	$0{\cdot}0_{2}34106$	$0{\cdot}0_{4}547035$		Hinrichs
*	Water	0 „ 24	0·0871	$0{\cdot}0_{2}33242$	$0{\cdot}0_{4}603$		Bunsen
*	Water	4·6 „ 24·2	0·085576	$0{\cdot}0_{2}30389$	$0{\cdot}0_{4}4979$		Hinrichs
Ethylene, . .	Water	0 „ 20	0·25629	$0{\cdot}0_{2}913631$	$0{\cdot}0_{3}188108$		Bunsen
	Water	4·6 „ 20·6	0·25487	$0{\cdot}0_{2}88312$	$0{\cdot}0_{3}17417$		Hinrichs
	Alcohol	0 „ 24	3·594984	0·0577162	$0{\cdot}0_{3}681$		Bunsen
	Alcohol	0·8 „ 23·8	3·5846	0·056153	$0{\cdot}0_{3}62369$		Hinrichs
Hydrogen, . .	Water	0 „ 26	0·0215286	$0{\cdot}0_{3}19216$	$0{\cdot}0_{5}17228$		Timofejeff
	Water	$\tau = 0 : t = 20$	0·02148	$0{\cdot}0_{3}2215$	$0{\cdot}0_{5}285$		Winkler
	Water	$= 10 : \; = 30$	0·01955	$0{\cdot}0_{3}1440$	$0{\cdot}0_{5}080$		„
	Water	$= 20 : \; = 40$	0·01819	$0{\cdot}0_{3}1525$	$0{\cdot}0_{5}325$		„
	Water	$= 30 : \; = 50$	0·01699	$0{\cdot}0_{3}0645$	$0{\cdot}0_{5}095$		„
	Alcohol	0°C. to 25°C.	0·06925	$0{\cdot}0_{3}1487$	$0{\cdot}0_{5}1$		Carius
	Alcohol	1 „ 23·7	0·0693	$0{\cdot}0_{3}16654$	$0{\cdot}0_{5}17445$		Hinrichs
Hydrogen sulphide,	Water	0 „ 40	4·3706	0·083687	$0{\cdot}0_{3}5213$		Schönfeld
	Water	2·0 „ 43·3	4·4015	0·089117	$0{\cdot}0_{3}61954$		Hinrichs
	Alcohol	0 „ 25	17·891	0·65598	$0{\cdot}0_{2}661$		Carius
	Alcohol	1 „ 22	18·019	0·71259	$0{\cdot}0_{2}88556$		Hinrichs

* Bunsen erroneously distinguished between "dimethyl" or "methyl gas" and "ethane": these numbers are for "methyl gas."

TABLE LXXIIIF.—*continued.*

Gas.	Solvent.	Range of Temperature.	β.	a.	b.	c.	Authority.
Methane, . .	Water	0° C. to 20° C.	+ 0·05449	$-0{\cdot}0_{2}11807$	$+0{\cdot}0_{4}10278$		Bunsen
	Water	6·2 „ 25·6	0·05473	$0{\cdot}0_{2}12265$	$0{\cdot}0_{4}11959$		Hinrichs
	Alcohol	0 „ 25	0·522586	$0{\cdot}0_{2}28655$	$0{\cdot}0_{4}142$		Carius
	Alcohol	2 „ 23·5	0·522745	$0{\cdot}0_{2}295882$	$0{\cdot}0_{4}177001$		Hinrichs
Nitric oxide, . .	Alcohol	0 „ 25	0·31606	$0{\cdot}0_{2}3487$	$0{\cdot}0_{4}49$		Carius
	Alcohol	2 „ 24·2	0·31578	$0{\cdot}0_{2}3469$	$0{\cdot}0_{4}4827$		Hinrichs
Nitrogen, . . .	Water	0 „ 20	0·020346	$0{\cdot}0_{3}53887$	$0{\cdot}0_{4}11156$		Bunsen
	Water	20 „ 40	0·1160291	$0{\cdot}0_{4}9834$			Hüfner
	Water	τ = 0 : t = 20	0·023481	$0{\cdot}0_{3}5799$	$0{\cdot}0_{5}885$		Winkler
	Water	= 10 : = 30	0·018567	$0{\cdot}0_{3}3702$	$0{\cdot}0_{5}558$		„
	Water	= 20 : = 40	0·015423	$0{\cdot}0_{3}2257$	$0{\cdot}0_{5}229$		„
	Water	= 30 : = 50	0·013395	$0{\cdot}0_{3}1876$	$0{\cdot}0_{5}306$		„
	Water	= 40 : = 60	0·011825	$0{\cdot}0_{3}1108$	$0{\cdot}0_{5}153$		„
	Water	= 50 : = 70	0·01087	$0{\cdot}0_{3}0745$	$0{\cdot}0_{5}095$		„
	Water	= 60 : = 80	0·01022	$0{\cdot}0_{3}0595$	$0{\cdot}0_{5}135$		„
	Alcohol	0° C. to 25 °C.	0·126338	$0{\cdot}0_{3}418$	$0{\cdot}0_{5}6$		Carius
	Alcohol	1·9 „ 23·8	0·12637	$0{\cdot}0_{3}42813$	$0{\cdot}0_{5}63046$		Hinrichs
Nitrous oxide, .	Water	0 „ 25	1·30521	0·045362	$0{\cdot}0_{3}6843$		Carius
	Water	2·5 „ 24	1·30623	0·046254	$0{\cdot}0_{3}72154$		Hinrichs
	Alcohol	0 „ 25	4·17805	0·069816	$0{\cdot}0_{3}609$		Carius
	Alcohol	2·3 „ 23	4·1902	0·074389	$0{\cdot}0_{3}78226$		Hinrichs
Oxygen, . .	Water	0 „ 20	0·041150	$0{\cdot}0_{2}108986$	$0{\cdot}0_{4}22563$		Bunsen
	Alcohol 99·7%	0 „ 24	0·23370	$0{\cdot}0_{3}74688$	$0{\cdot}0_{5}3288$		Timofejeff
	Water	τ = 0 : t = 30	0·04890	$0{\cdot}0_{2}13413$	$0{\cdot}0_{4}283$	$-0{\cdot}0_{6}29534$	Winkler
	Water	= 20 : = 40	0·03102	$0{\cdot}0_{3}5900$	$0{\cdot}0_{5}960$		„
	Water	= 30 : = 50	0·02608	$0{\cdot}0_{3}3450$	$0{\cdot}0_{5}430$		„
	Water	= 40 : = 60	0·02306	$0{\cdot}0_{3}2520$	$0{\cdot}0_{5}360$		„
	Water	= 50 : = 70	0·02090	$0{\cdot}0_{3}1595$	$0{\cdot}0_{5}155$		„
	Water	= 60 : = 80	0·01946	$0{\cdot}0_{3}1335$	$0{\cdot}0_{5}205$		„
Propylene, . .	Water	1·4° C. to 18·3° C.	0·446506	0·022075	$0{\cdot}0_{3}5388$		v. Than
Sulphur dioxide, .	Water	0 „ 20	79·789	2·6077	0·029349		Schönfeld
	Water	21 „ 40	75·182	2·1716	0·01903		„
	Alcohol	0 „ 25	327·798	16·8437	0·8066		Carius

One volume of saturated aqueous solution between 0° C. and 20° *contains* $(68{\cdot}861 - 1{\cdot}87025t + 0{\cdot}01225t^2)$ volumes of SO_2, and between 21° and 40° $(60{\cdot}952 - 1{\cdot}38898t + 0{\cdot}00726t^2)$ volumes of SO_2.

Winkler found the following expression very approximately true in the case of water and the gases H_2, N_2, CO, NO, and O_2:—

$$\beta_\tau = \beta_t\left(1 - \frac{\mu_t - \mu_\tau}{\mu_t}\sqrt[3]{\frac{m}{M}}\right) = \beta_t\left(1 - \frac{\mu_t - \mu_\tau}{\mu_t} \cdot \frac{\sqrt[3]{m}}{k}\right),$$

where β_τ, β_t = coefficient of absorption of the gas at $\tau°$ and $t°$ respectively,
μ_τ, μ_t = internal friction of the absorbed gas at $\tau°$ and $t°$ „
m = molecular weight of gas,
M = molecular weight of the solvent,
k = A constant $= \sqrt[3]{M}$.

Calculating the value of k from experimental results he gets for—

H_2 in water	$k = 3{\cdot}604$	NO in water	$k = 3{\cdot}759$
N_2 „	$= 3{\cdot}880$	O_2 „	$= 3{\cdot}810$
CO „	$= 3{\cdot}872$	Mean „	$= 3{\cdot}785$

Supposing that the molecule of liquid water corresponds to $3H_2O$, he gets:—

$$\sqrt[3]{M} = \sqrt[3]{54} = 3{\cdot}7798 = k.$$

Taking this value for k, Winkler calculated the values of β at 5°, 10°, 15°, 20°, 25°, 30°, 40°, 50°, and 60° C. from the value of β at 0° C. by the help of his equation, and found them agree very closely with his experimental results. The deviation shows a decided tendency to increase with the rise of temperature; and in every case except that of hydrogen, it is in the direction that the equation indicates if we admit that the molecules of liquid water tend to become less complex as the temperature rises—*i.e.* the mean value of $\sqrt[3]{M}$ diminishes as dissociation proceeds. Possibly there will be also some change in the mean value of m as the temperature varies.

TABLE LXXIV.—**Molecular Weights.**

I. According to Avogadro's Law we have in case of gaseous bodies—

$$\mathfrak{M}_A : \mathfrak{M}_B = \mathfrak{D}_A : \mathfrak{D}_B$$

and the calculation of Molecular Weights from Vapour Densities has been explained in section LXI.

II. "**Cryoscopic or Lowering of Freezing Point" Method.** (Raoult's, Beckmann's)—

Let d = Number of degrees the freezing point of the solvent is lowered when
p = Grammes of substance dissolved in 100 grms. of solvent,
E = Constant to be determined for each special solvent = Number of degrees the freezing point of the solvent would be lowered if a gramme-molecule of the substance were dissolved in 100 grms. of the solvent,
= "Molecular Depression" for that special solvent,

$$\therefore \quad \mathfrak{M} = E\frac{p}{d};$$

or, putting S = Weight of solvent used,
s = Weight of substance in solution,

$$\mathfrak{M} = 100E.\frac{s}{Sd}.$$

E can be determined experimentally for each solvent by noticing the value of d when known weights of substances of known molecular weights are dissolved in a known weight of the solvent, or it may be calculated for any substance whose freezing point and latent heat of liquefaction are known. The researches of Pfeffer, van't Hoff, etc., have shown that in fairly dilute solutions "Dissolved substances exert, in the form of osmotic pressures, the same pressure as they would exert at the same temperature as gases occupying the same space as their solutions occupy, and this osmotic pressure is directly proportional to the absolute temperature":—that is, for substances in dilute solutions, as well as for substances in the gaseous state,—

$$PV = KT,$$

where V is the molecular volume, and K a constant virtually independent of the nature of the dissolved substance, and the same as for gaseous substances.

If with N molecules of a solvent, whose freezing point is T, we associate n molecules of a foreign substance, and cool it down to $(T - d)$ until the solvent begins to solidify, and allow as much of it to solidify as was associated with one molecule of the foreign substance, we shall lose osmotic pressure, P, through the volume, V, of $\frac{N}{n}$ molecules of the solvent—*i.e.*, PV units of work. If $\mathfrak{L}$ represent the molecular latent heat of the

solvent, $\frac{N}{n}$ molecules in solidifying lose $\frac{N\mathfrak{L}}{n}$ calories, and we know $\frac{PV}{\frac{N\mathfrak{L}}{n}} = \frac{PVn}{N\mathfrak{L}} = \frac{d}{T}$,

$\therefore\ d = \frac{PVnT}{N\mathfrak{L}}$.

Now $PV = KT$,

$$\therefore\ d = \frac{KnT^2}{N\mathfrak{L}};$$

or, putting λ = Latent heat of liquefaction of unit mass of solvent,
M = Molecular weight of solvent,

we get $\qquad d = \frac{KnT^2}{NM\lambda}$.

Now, with n molecules each of mass $\mathfrak{M}$ to N molecules each of mass M, we get

$$p = \frac{100n\mathfrak{M}}{NM},$$

$\therefore$ Depression caused by 1 grm. substance to 100 grms. solvent $= \frac{NMd}{100n\mathfrak{M}}$,

and ,, ,, $\mathfrak{M}$ grms. ,, ,, ,, ,, $= \frac{NMd}{100n} = E$.

Substitute for d its value $\frac{KnT^2}{NM\lambda}$, and we get $E = \frac{KT^2}{100\lambda}$,

which is van't Hoff's equation.

As λ is generally expressed in gramme-degree calories, we have to find K in terms of the same unit.

If P be expressed in atmospheres and V in litres, we get—

$$PV = 0^\circ\ \text{C. under 760 mm. pressure} = 22{\cdot}3276\ \text{litre-atmospheres} = 273K.$$
$$\therefore\ K = 0{\cdot}08179\ \text{litre-atmospheres.}$$

Now, 1 "Litre-atmosphere" $= 76 \times 13{\cdot}5953 \times 1000 = 1033243$ centimetre-gramme units of work,

1 Gramme-degree calorie = 42750 centimetre-grammes,

$\therefore$ 1 "Litre-atmosphere" = 24·1694 calories,

K = 1·976 calories = 2 calories, say,

$$\therefore\ E = \frac{0{\cdot}02T^2}{\lambda}.$$

The determination of the latent heat of fusion is so difficult in many instances, that the values of E calculated from van't Hoff's formula can only be very roughly approximate in these cases: in many instances, however, the calculated values agree very closely with experimental results.

.BLE LXXIVA.

E for various Solvents.

rmula.	T − 273 Solidifying Point on Centigrade Scale.	λ Latent Heat of Liquefaction.	E "Molecular Depression."	
			Calculated from $E = \frac{0 \cdot 02T^2}{\lambda}$	Obtained Experimentally.
Br_2	−7°·32	16·185	87·2	83 (?)
P_4	44·2	5·24	384	
I_2	113		255	
S_2	113·6	9·368	319	
Hg	−38·85	2·82	388·8	
"	"	"	425 (?)	
Ga	30	19·11	95·8	
Na_2	97·6	7·6	360	
Sn	228	13·314	377	
Bi	266·8	12·64	466	
Cd	320·7	13·66	516	
Pb	325	5·858	1221	
Zn	415·3	28·13	334	
Ag	999	21·07	1537	
Pd	1500	36·3	1759	
Pt	1779	27·18	3098	
H_2O	0	79·24	18·9	18·5
H_2O	0	80·025	18·57	
ICl	16·5	14·15	118	
I_3PO_2	17·4	36·36	46	
I_3PO_3	18	37·44	48	
I_3PO_4	18	25·71	65·8	
$[_2SO_4$	10·35	24·031	66·4	
$[_4SO_5$	8·53	39·918	39·7	
$[_6SO_6$	11·5	31·72	51·3	
aNO_3	305·8	64·87	103·3	
NO_3	333·5	48·9	150·4	
bCl_2	485	20·9	550	
bBr_2	490	12·34	943	
PbI_2	375	11·5	730	
bCl_3		13·37	177	184
bBr_3		9·73	274	267
sBr_3			206	194·2
nBr_4			305	280
POCl				69
COOH	−7·5	57·38	28·4	27·7

TABLE LXXIVA.—*continued.*

Solvent. Name.	Solvent. Formula.	T − 273 Solidifying Point on Centigrade Scale.	λ Latent Heat of Liquefaction.	E "Molecular Depression." Calculated from $E=\frac{0\cdot02T^2}{\lambda}$	E "Molecular Depression." Obtained Experimentally.
Acetic acid, . .	CH_3COOH	16°·7	43·2	33·8	39
Caproic acid, . .	$C_5H_{11}COOH$	27	40·6	44·7 (?)	47
Lauric acid, . .	$C_{11}H_{23}COOH$	43 ·4	43·7	45·2	44
Palmitic acid, . .	$C_{15}H_{31}COOH$	59 ·9	50·4	44·5	44
Stearic acid, . .	$C_{17}H_{35}COOH$	53	54·4	42·5	44
Phenyl-propionic acid,	$C_6H_5.CH_2CH_2COOH$	48 ·5	24·8	82·6	88
Benzol, . . .	C_6H_6	1 ·95	29·089	53	50
,, . . .	,,	5 ·5	30	51	49
Paraxylol, . .	$C_6H_4(CH_3)_2$ (1 : 4)	16	39·3	42·5	
Naphthalene, . .	$C_{10}H_8$	79 ·97	35·679	69·8	
,, . .	,,	79 ·20	35·500	69·4	70
,, . .	,,	79 ·87	35·625	69·9	
,, . .	,,	80	35·5	69·4	71
Diphenyl, . .	$C_6H_5.C_6H_5$	70 ·2	29·4	80	79·4
,, . .	,,	70 ·2	28·5	84	82
Phenanthrene, . .	$C_{14}H_{10}$	96 ·25	22·72	120	120
Glycerol, . .	$C_3H_5(OH)_3$	13	42·5	38·5	38·4
Aethal (cetyl alcohol),	$C_{16}H_{33}OH$	49 ·6	34·3	59·7	62
Diphenyl methane, .	$CH_2(C_6H_5)_2$	26 ·3	27·1	65·6	
,, ,, .	,,	26	,,	,,	67
Stearin, . . .	$(C_{17}H_{35}CO_2)_3C_3H_5$	55 ·6	47·3	49·2	51
Phenol, . . .	C_6H_5OH	39 ·6	26·9	70	74
,, . . .	,,	39	25	76	74
p-Cresol, . . .	$C_6H_4.CH_3.OH$	35°·9	27·1	69·6	
,, . . .	,,	36			74
Thymol, . . .	$C_6H_3.CH_3.C_3H_7.OH$(5:2:1)	48 ·2	27·9	73·9	
,, . . .	,,	48 ·2	27·5	85	83
Anethol, . . .	$C_9H_9.OCH_3$	20 ·1	27·9	61·2	62
Benzophenone, . .	$C_6H_5.CO.C_6H_5$	48 ·1	23·2	87·8	95
Chloral hydrate, .	$CCl_3CH(OH)_2$	46	33·22	61·4	
Chloral-alcoholate, .	$CCl_3CHOH.OC_2H_5$	46 ·2	27	74·4	78
Ethylene bromide, .	$CH_2Br.CH_2Br$	7 ·9	13	119	118
p-Monobromphenol, .	C_6H_4BrOH (1 : 4)	63	22·9	100	107
Dichlor -*o*-xylol, .	$C_8H_8Cl_2$	55	29	74·2	
,, -*m*- ,, .	,,	34	26·7	70·6	
,, -*p*- ,, .	,,	100	32·7	85	
Tetrachlor-*o*- ,, .	$C_8H_6Cl_4$	86	21	122·6	
,, -*p*- ,, .	,,	95	22·1	122·6	

TABLE LXXIVa.—*continued.*

Solvent.		$T-273$ Solidifying Point on Centigrade Scale.	λ Latent Heat of Liquefaction.	E "Molecular Depression."	
Name.	Formula.			Calculated from $E=\frac{0\cdot02T^2}{\lambda}$	Obtained Experimentally.
Dibrom-*o*-xylol, . .	$C_8H_8Br_2$	77°	21·45	114·2	
" -*p*- " . .	"	95	24·25	111·7	
Nitrobenzol, . .	$C_6H_5.NO_2$	– 9 ·21	22·3	69·5	70·7
Nitronaphthalene, .	$C_{10}H_9NO_2$	56	25·32	85·5	
Diphenylamine, .	$NH(C_6H_5)_2$	50 ·2	21·3	98·6	88
Naphthylamine, .	$NH_2C_{10}H_7$	47 ·1	19·7	102·5	78
Urethylane, . .	NH_2COOCH_3	50	48·5	43	44
Urethane, . .	$NH_2COOC_2H_5$	48 ·7	41	49·6	
" . . .	"	48 ·7	41	50	50
Acetoxime, . .	$(CH_3)_2C:N.OH$	59 ·4	41·4	52·9	55
Azobenzol, . .	$C_6H_5.N_2.C_6H_5$	69 ·1	29·4	77·6	
" . .	"	69 ·1	29·2	83	82
p-Toluidine, . .	$C_6H_4.CH_3.NH_2$	42 ·5	38·6	49	51·1
" . .	"	42 ·5	39	49	52
Nitric peroxide, .	NO_2	– 10	32–37	43–37	41

Gaseous molecules under a very slight pressure tend to dissociate; while, when subjected to a very great pressure, several comparatively simple molecules often coalesce to form more complex ones. It also happens similarly with solutions: in very dilute ones our calculated molecular weights may come out too low, and in concentrated ones they are certain to be much too high—*i.e.*, in dilute solutions the "Specific Depression" $\frac{d}{p}$ is likely to be abnormally high, while in concentrated solutions it is most likely to be abnormally low. Thus, with 100 grms. benzol (E = 49) 0·164 grm. of ethyl alcohol caused a depression = 0°·175, giving

$$\mathfrak{M} = 49 \times \frac{164}{175} = 45\cdot9.$$

With the same weight of solvent 32·45 grms. of the alcohol caused a depression = 5°, giving

$$\mathfrak{M} = 49 \times \frac{32\cdot45}{5} = 318.$$

The vapour density gives C_2H_5OH as the molecular formula and $\mathfrak{M} = 46$.

TABLE LXXIVB.

It must also be borne in mind that substances may form complex molecules with some of the solvent—thus, calcium chloride in aqueous solution seems to exist as $CaCl_2 6H_2O$ rather than $CaCl_2$, and in neither case will the experimental result for E agree with the calculated one.

$CaCl_2$			$CaCl_2 6H_2O$	
$\frac{d}{p}$	p	d	p	$\frac{d}{p}$
0·40	1	0°·4	1·99	0·201
45	2	0 ·9	4·02	223
463	4	1 ·85	8·21	225
475	6	2 ·85	12·57	226
488	8	3 ·9	17·20	226
490	10	4 ·9	21·80	224
528	14	7 ·4	31·89	232
555	18	10 ·0	43·05	231

The last two results seem to indicate a more complex hydrate than $CaCl_2.6H_2O$, and we have frequent indications that the degree of hydration differs in solutions of different strengths. Thus, with sodium chloride the results up to 14 grms. NaCl to 100 grms. of water seem to indicate molecules of NaCl, and above that strength of $NaCl.2H_2O$.

NaCl			$NaCl.2H_2O$.	
$\frac{d}{p}$	p	d	p	$\frac{d}{p}$
0·600	1	0°·6	1·625	0·369
600	2	1 ·2	3·271	366
600	4	2 ·4	6·625	362
600	6	3 ·6	10·064	358
600	8	4 ·8	13·592	353
600	12	7 ·2	20·930	344
600	14	8 ·4	24·747	339
613	15	9 ·2	26·695	340
619	16	9 ·9	28·669	341
623	17	10 ·6	30·670	341
633	18	11 ·4	32·699	343
637	19	12 ·1	34·756	342
640	20	12 ·8	36·842	342

TABLE LXXIVB.—*continued.*

Rüdorff noticed that dilute solutions of Cupric chloride have a blue tint, while stronger solutions are decidedly green.

Grammes, $CuCl_2$ to 100 Grms. of Water.	d	$CuCl_2, 4H_2O$		$CuCl_2, 12H_2O$	
		p	$\frac{d}{p}$	p	$\frac{d}{p}$
2·39	0°·85	3·72	0·229	6·49	0·131
4·91	1 ·8	7·75	232	13·76	131
11·04	4 ·6	18·03	257	35·03	131
14·94	6 ·6	24·95	264	51·32	128
16·43	7 ·4	27·66	267	58·33	127
16·53	7 ·5	27·87	269	58·82	127
20·70	10 ·0	35·78	280	80·99	123
22·45	10 ·95	39·22	280	91·87	119
24·04	12 ·05	42·40	284	102·31	117
25·46	12 ·85	45·21	284	112·55	114
26·04	13 ·1	46·50	282	116·96	112
28·46	14 ·55	51·61	282	137·02	106
33·00	17 ·4	61·61	282	179·79	096
33·88	18 ·15	63·62	285	194·40	093

TABLE LXXIVC.—Values of E experimentally obtained.

(Raoult's.)

(1) FOR WATER. *Calculated value of* E = 18·9.

Substance dissolved.		E.
Name.	Formula.	
Methyl alcohol, ...	CH_3OH	17·3
Ethyl ,, ...	C_2H_5OH	17·3
Butyl ,, ...	C_4H_9OH	17·2
Glycerol, ...	$C_3H_5(OH)_3$	17·1
Mannite, ...	$CH_2(OH).(CH.OH)_4CH_2OH$	18·0
Invert sugar, ...	$C_6H_{12}O_6$	19·3
Milk ,, ...	$C_{12}H_{22}O_{11}.H_2O$ (?)	18·1
Cane ,, ...	$C_{12}H_{22}O_{11}$	18·5
Salicin, ...	$C_6H_{11}O_5.O.C_6H_4.CH_3OH$	17·2
Phenol, ...	$C_6H_5.OH$	15·5
Pyrogallol, ...	$C_6H_3.(OH)_3$ (1 : 2 : 3)	16·3
Chloral hydrate, ...	$CCl_3CH(OH)_2$	18·9
Acetone, ...	$CH_3.CO.CH_3$	17·1

TABLE LXXIVc.—*continued.*

Substance dissolved. Name.	Formula.	E.
Hydrogen formate,	$HCOOH$	19·3
,, acetate,	CH_3COOH	19·0
,, butyrate,	C_3H_7COOH	18·7
,, lactate,	$CH_3.CH(OH).COOH$	19·2
,, malate,	$COOH.CH_2.CH(OH).COOH$	18·7
,, tartrate,	$COOH.(CH.OH)_2COOH$	19·5
,, citrate,	$COOH.C(OH)(COOH).CH_2.COOH$	19·3
,, oxalate,	$COOH.COOH$	22·9
Ether,	$(C_2H_5)_2O$	16·6
Ethyl acetate,	$CH_3COOC_2H_5$	17·8
Acetamide,	$CH_3.CO.NH_2$	17·8
Urea,	$CO(NH_2)_2$	17·2
Ammonia,	NH_3	19·9
Ethylamine,	$NH_2C_2H_5$	18·5
Propylamine,	$NH_2C_3H_7$	18·4
Aniline,	$NH_2C_6H_5$	15·3
Hydrogen cyanide,	HCN	19·4
,, chloride,	HCl	39·1
,, bromide,	HBr	39·6
,, nitrate,	HNO_3	35·8
,, perchlorate,	$HClO_4$	38·7
,, arsenate,	H_3AsO_4	42·6
,, phosphate (Ortho),	H_3PO_4	42·9
,, sulphate,	H_2SO_4	38·2
,, selenite,	H_2SeO_3	42·9
Lithium hydroxide,	$LiOH$	37·4
Sodium ,,	$NaOH$	36·2
Potassium ,,	KOH	35·3
Lithium chloride,	$LiCl$	36·8
Sodium ,,	$NaCl$	35·1
Potassium ,,	KCl	33·6
Ammonium ,,	NH_4Cl	34·8
Potassium bromide,	KBr	35·1
,, iodide,	KI	35·2
,, cyanide,	KCN	32·2
,, ferrocyanide,	$K_4Fe(CN)_6$	46·3
,, ferricyanide,	$K_3Fe(CN)_6$	47·3
Sodium nitroprusside,	$Na_2Fe(CN)_5NO + 2H_2O$	46·8
Potassium thiocyanate,	$KCNS$	33·2
Sodium nitrate,	$NaNO_3$	34·0
Potassium nitrate,	KNO_3	30·8
Ammonium ,,	NH_4NO_3	32
Potassium formate,	$HCOOK$	35·2
Sodium acetate,	CH_3COONa	32·0

TABLE LXXIVc.—*continued.*

Substance dissolved.		E.
Name.	Formula.	
Potassium acetate, ...	CH_3COOK	34·5
Sodium carbonate, ...	Na_2CO_3	40·3
Potassium ,, ...	K_2CO_3	41·8
Sodium sulphate, ...	Na_2SO_4	35·4
Potassium ,, ...	K_2SO_4	39·0
Potassium-hydrogen sulphate, .	$KHSO_4$	34·8
Ammonium sulphate, . . .	$(NH_4)_2SO_4$	37·0
Borax, ...	$Na_2B_4O_7$	66·0
Potassium chromate, . . .	K_2CrO_4	38·1
,, dichromate, . .	$K_2Cr_2O_7$	43·7
Disodium phosphate, . . .	Na_2HPO_4	37·9
Sodium pyrophosphate, . .	$Na_4P_2O_7$	45·8
,, oxalate, ...	$Na_2C_2O_4$	43·2
Potassium oxalate, ...	$K_2C_2O_4$	46·8
Sodium tartrate, ...	$Na_2C_4H_4O_6$	44·2
,, ditartrate, ...	$NaHC_4H_4O_6$	31·2
Potassium tartrate, ...	$K_2C_4H_4O_6$	36·3
Barium oxide, ...	BaO	49·7
Strontium oxide, ...	SrO	48·2
Calcium ,, ...	CaO	48·0
,, chloride, ...	$CaCl_2$	49·9
Strontium ,, ...	$SrCl_2$	51·1
Barium ,, ...	$BaCl_2$	48·6
Cupric ,, ...	$CuCl_2$	47·8
Calcium nitrate, ...	$Ca(NO_3)_2$	37·4
Strontium ,, ...	$Sr(NO_3)_2$	41·2
Barium ,, ...	$Ba(NO_3)_2$	40·5
Lead ,, ...	$Pb(NO_3)_2$	37·4
Barium formate, ...	$(HCOO)_2Ba$	48·2
Magnesium acetate, ...	$(CH_3COO)_2Mg$	47·8
Barium ,, ...	$(CH_3COO)_2Mg$	48·6
Sulphurous acid, ...	SO_2	20·0
Hydrogen sulphide, ...	H_2S	19·2
Arsenious oxide, ...	As_4O_6	20·3
Hydrogen metaphosphate, . .	HPO_3	21·7
Boric acid, ...	B_2O_3	20·5
Tartar emetic, ...	$(KSbOC_4H_4O_6)_2 + H_2O$	18·4
Mercuric cyanide, ...	$Hg(CN)_2$	17·5
Magnesium sulphate, . . .	$MgSO_4$	19·2
Ferrous ,, ...	$FeSO_4$	18·4
Copper ,, ...	$CuSO_4$	18·0
Zinc . ,, ...	$ZnSO_4$	18·2

TABLE LXXIVc.—*continued.*

(2) For Acetic Acid. *Calculated value of* E = 38·8.

Substance dissolved.		E.
Name.	Formula.	
Methyl iodide,	CH_3I	38·8
Chloroform,	$CHCl_3$	38·6
Carbon tetrachloride,	CCl_4	38·9
,, disulphide,	CS_2	38·4
Hexane,	C_6H_{14}	40·1
Turpentine,	$C_{10}H_{16}$	39·2
Naphthalene,	$C_{10}H_8$	39·2
Ethylene chloride,	$C_2H_4Cl_2$	40·0
Nitrobenzol,	$C_6H_5NO_2$	41·0
Methyl nitrate,	CH_3NO_3	38·7
,, salicylate,	$C_6H_4OHCOOCH_3$	39·1
Ether,	$(C_2H_5)_2O$	39·4
Ethyl sulphide,	$(C_2H_5)_2S$	38·5
,, cyanide,	C_2H_5CN	37·6
,, formate,	$HCOOC_2H_5$	37·2
,, valerate,	$C_4H_9COOC_2H_5$	39·6
Mustard oil,	C_2H_5CNS	38·2
Aldehyde,	CH_3COH	38·4
Chloral,	CCl_3COH	39·2
Benzylic aldehyde,	C_6H_5COH	39·7
Camphor,	$C_{10}H_{16}O$	39·0
Acetone,	CH_3COCH_3	38·1
Acetic anhydride,	$(CH_3CO)_2O$	36·6
Hydrogen formate,	$HCOOH$	36·5
,, butyrate,	C_3H_7COOH	37·3
,, valerate,	C_4H_9COOH	39·2
,, benzoate,	C_6H_5COOH	43·0
,, camphorate,	$C_6H_9(C_2H_5)(COOH)_2$	40·0
,, salicylate,	$C_6H_4OHCOOH$	40·5
,, picrate,	$C_6H_2(NO_2)_3.OH$	39·8
,, cyanide,	HCN	36·6
Methyl alcohol,	CH_3OH	35·7
Ethyl ,,	$C_2H_5.OH$	36·4
Butyl ,,	$C_4H_9.OH$	38·7
Amyl ,,	$(C_2H_5)_2CH.OH$	39·4
Allyl ,,	$C_3H_5.OH$	39·1
Glycerol,	$C_3H_5(OH)_3$	36·2
Salicin,	$C_{13}H_{18}O_7$	37·9
Santonin,	$C_{15}H_{18}O_3$	38·1
Phenol,	C_6H_5OH	36·2
Pyrogallol,	$C_6H_3(OH)_3$ (1 : 2 : 3)	37·3
Acetamide,	CH_3CONH_2	36·1

TABLE LXXIVc.—*continued.*

Substance dissolved. Name.	Formula.	E.
Ammonium acetate,	CH_3COONH_4	35·0
Aniline ,,	$CH_3COONH_2C_6H_5$	36·2
Brucine ,,		40·0
Codeine ,,		38·3
Morphine ,,		43·0
Quinine ,,		41·0
Strychnine ,,		41·6
Potassium ,,	CH_3COOK	39·0
Sulphur chloride,		38·7
Arsenious ,,	$AsCl_3$	41·5
Stannic ,,	$SnCl_4$	41·3
Hydrogen sulphide,	H_2S	35·6
Sulphur dioxide,	SO_2	38·5
Hydrogen sulphate,	H_2SO_4	18·6
,, chloride,	HCl	17·2
Magnesium acetate,	$(CH_3COO)_2Mg$	18·2

(3) For Formic Acid. *Calculated value of* E = 28·4.

Chloroform,	$CHCl_3$	26·5
Benzol,	C_6H_6	29·4
Ether,	$(C_2H_5)_2O$	28·2
Aldehyde,	CH_3COH	26·1
Acetone,	CH_3COCH_3	27·8
Acetic acid,	CH_3COOH	26·5
Brucine formate,		29·7
Potassium ,,	$HCOOK$	28·9
Arsenious chloride,	$AsCl_3$	26·6
Magnesium formate,	$(HCOO)_2Mg$	13·9

(4) For Ethylene-Bromide. *Calculated value of* E = 119.

Carbon disulphide,	CS_2	117
Chloroform,	$CHCl_3$	118
Benzol,	C_6H_5	119
Ether,	$(C_2H_5)_2O$	117
Arsenious chloride,	$AsCl_3$	118
Acetic acid,	CH_3COOH	58
Ethyl alcohol,	C_2H_5OH	57

(5) For Benzol. *Calculated value of* E = 53. (51).

Hexane,	C_6H_{14}	51·3
Turpentine,	$C_{10}H_{16}$	49·8
Naphthalene,	$C_{10}H_8$	50·0
Anthracene,	$C_{14}H_{10}$	51·2

TABLE LXXIVc.—*continued.*

Substance dissolved. Name.	Formula.	E.
Chloroform,	$CHCl_3$	51·1
Carbon tetrachloride,	CCl_4	51·2
,, disulphide,	CS_2	49·7
Methyl iodide,	CH_3I	50·4
Ethyl bromide,	C_2H_5Br	50·2
,, iodide,	C_2H_5I	51·6
Ethylene chloride,	$C_2H_4Cl_2$	48·6
Nitrobenzol,	$C_6H_5NO_2$	48·0
Methyl nitrate,	$CH_3.NO_3$	49·3
,, oxalate,	$(CH_3)_2C_2O_4$	49·2
,, salicylate,	$C_6H_4.OHCOOCH_3$	51·5
Ether,	$(C_2H_5)_2O$	49·7
Ethyl sulphide,	$(C_2H_5)_2S$	51·8
,, cyanide,	C_2H_5CN	51·6
,, formate,	$HCOOC_2H_5$	49·3
,, valerate,	$C_4H_9COOC_2H_5$	50·0
Mustard oil,	C_2H_5CNS	51·4
Nitroglycerol,	$C_3H_5(ONO_2)_3$	49·9
Tri-butyrin,	$(C_3H_5COO)_3C_3H_5$	48·7
Tri-olein,	$(C_{17}H_{33}COO)_3C_3H_5$	49·8
Aldehyde,	CH_3COH	48·7
Chloral,	CCl_3COH	50·3
Benzaldehyde,	C_6H_5COH	50·1
Camphor,	$C_{10}H_{16}O$	51·4
Acetone,	CH_3COCH_3	49·3
Valeral,	C_4H_9COH	51·0
Acetic anhydride,	$(CH_3CO)_2O$	47·0
Santonin,	$C_{15}H_{18}O_3$	50·2
Hydrogen picrate,	$CH_2(NO_2)_3OH$	49·9
Aniline,	$NH_2.C_6H_5$	46·3
Codeine,	$C_{17}H_{17}(OCH_3)OHNO+H_2O$	48·7
Narcotine,	$C_{22}H_{23}NO_7$	52·1
Thebaine,	$C_{19}H_{21}NO$	48·0
Sulphur chloride,		51·1
Arsenious ,,	$AsCl_3$	49·6
Phosphorous ,,	PCl_3	47·2
Phosphoric ,,	PCl_5	51·6
Stannic ,,	$SnCl_4$	48·8
Methyl alcohol,	CH_3OH	25·3
Ethyl ,,	C_2H_5OH	28·2
Butyl ,,	C_4H_9OH	43·2
Amyl ,,	$C_5H_{11}OH$	39·7
Phenol	C_6H_5OH	32·4
Hydrogen formate,	$HCOOH$	23·2
,, acetate,	CH_3COOH	25·3
,, valerate,	C_4H_9COOH	27 1
,, benzoate,	C_6H_5COOH	25·4

TABLE LXXIVc.—*continued.*

(6) For Nitrobenzol. *Calculated value of* E = 69·5.

Substance dissolved.		E.
Name.	Formula.	
Benzol,	C_6H_6	70·6
Naphthalene,	$C_{10}H_8$	73·6
Turpentine,	$C_{10}H_{16}$	69·8
Chloroform,	$CHCl_3$	69·9
Carbon disulphide,	CS_2	70·2
Ether,	$(C_2H_5)_2O$	67·4
Ethyl acetate,	$CH_3COOC_2H_5$	72·3
,, valerate,	$C_4H_9COOC_2H_5$	73·2
Benzaldehyde,	C_6H_5COH	70·3
Acetone,	CH_3COCH_3	69·2
Codeine,	$C_{17}H_{17}(OCH_3)OHNO + H_2O$	73·5
Arsenious chloride,	$AsCl_3$	67·5
Stannous ,,	$SnCl_2$	71·4
Methyl alcohol,	CH_3OH	35·4
Ethyl ,,	C_2H_5OH	35·6
Hydrogen acetate,	CH_3COOH	36·1
,, valerate,	C_4H_9COOH	42·4
,, benzoate,	C_6H_5COOH	37·7

Where the values of E are much higher than the calculated magnitude, it is quite evident that dissociation or ionisation must have taken place; and where the values are too low, polymerisation must have occurred.

III. Vapour Tension, and "Ebullistic or Boiling Point" Method. (Beckmann's, etc.)

Arrhenius' Law: "The rise (dT) of the boiling point (T) of a solvent, caused by dissolving n gramme-molecules of a comparatively non-volatile substance in 100 grms. of the solvent, is directly proportional to n and the square of T; and indirectly proportional to λ, the latent heat of vaporisation of 1 grm. of the solvent."

From this it follows that the formula

$$\mathfrak{M} = E \cdot \frac{p}{d}$$

is applicable also when d = Change of boiling temperature when p grammes of a substance are dissolved in 100 grms. of the solvent.

Also,

$$E = \frac{0{\cdot}02T^2}{\lambda},$$

where T = Boiling temperature on absolute scale,

λ = Latent heat of vaporisation of 1 grm. of solvent at T°.

This law can be deduced from thermodynamical principles, but the full investigation would be out of place here, and we can only give such equations and tables as are likely to be useful in actual experimental work.

If Π denote the vapour pressure of the pure solvent at temperature T,
Π_1 ,, ,, ,, of a solution of a fairly non-volatile substance in such a solvent, then,—

$\frac{\Pi - \Pi_1}{\Pi}$ = a constant for same degree of concentration, and the value of such constant is quite independent of the temperature as long as the solution is dilute, and as long as the vapour pressure of the dissolved substance is an infinitesimally small quantity compared with that of the solvent at the same temperature. This law can be deduced from thermodynamical principles, and it has also been established experimentally.

If n represent the number of molecules of the dissolved substance associated with N molecules of the solvent, we get—

$$\frac{\Pi - \Pi_1}{\Pi} = C\frac{n}{N+n}.$$

The limiting value of C is evidently $= 1$,

consequently we may put $\frac{\Pi - \Pi_1}{\Pi} = \frac{n}{N+n}$, *i.e.*, $\frac{\Pi - \Pi_1}{\Pi_1} = \frac{n}{N}$.

Employing p and M as in last section,—

$$n = \frac{p}{\mathfrak{M}}, \text{ and } N = \frac{100}{M}.$$

$$\frac{\Pi - \Pi_1}{\Pi_1} = \frac{Mp}{100\mathfrak{M}},$$

so we get . . . . $$\mathfrak{M} = \frac{Mp\Pi_1}{100(\Pi - \Pi_1)},$$

and . . . . $$M = \frac{100(\Pi - \Pi_1)\mathfrak{M}}{p\Pi_1};$$

or, if w = weight dissolved n 1 gramme molecule of solvent, $\mathfrak{M} = \frac{w\Pi_1}{\Pi - \Pi_1}$.

The great difficulty of measuring minute differences of vapour pressures, and the comparative ease of estimating changes in boiling temperature under constant pressure, has led to the adoption of the "Boiling Point" method in preference to the "Vapour Tension" mode of procedure. In using the Boiling Point method the temperature must be that of the liquid, and not that of the vapour.

In addition to van't Hoff's formula, we have another approximate expression for E (Schiff, Tronter), viz., $E = 0{\cdot}00096TM$, where M is the molecular weight of the solvent; or, taking more exact values for the constants,

$$E = 0{\cdot}01976\frac{T^2}{\lambda} = 0{\cdot}0009565MT.$$

The equality of the two expressions depends on the equation $\frac{M\lambda}{T}$ = a constant $= 20{\cdot}658$ very nearly, and for a large number of solvents.

The following table includes nearly all liquids whose boiling points under 760 mms. pressure, and latent heats of vaporisation, are known.

TABLE LXXIVD.

Solvent. Name.	Solvent. Molecular Formula.	Molecular Weight of Solvent.	T − 273.	λ	Value of E. $0{\cdot}01976\frac{T^2}{\lambda}$	Value of E. $0{\cdot}000565MT$	$\frac{M\lambda}{T}$
Bromine,	Br_2	159·5	61°·55	43·694	50·21	51·04	20·83
Mercury,	Hg	200	350	62	123·70	119·18	19·90
Sulphur,	S	32	316	362	18·94	18·03	19·67
Phosphorus trichloride,	PCl_3	137·5	78 ·5	51·42	47·98	46·23	20·12
Stannic chloride,	$SnCl_4$	260	112 ·5	30·53	96·18	95·91	20·59
Carbon disulphide,	CS_2	76	46 ·2	86·67	23·23	23·20	20·63
,, tetrachloride,	CCl_4	153·5	76 ·2	46·35	51·98	51·27	20·37
Benzol,	C_6H_6	78	80 ·35	93·45	26·40	26·38	20·63
Toluol,	C_7H_8	92	110 ·8	83·55	34·84	33·77	20·28
Ethylbenzol,	C_8H_{10}	106	134 ·7	76·40	42·99	41·34	19·86
Metaxylol,	C_8H_{10}	106	139 ·9	78·25	43·05	41·76	20·09
Propylbenzol,	C_9H_{12}	120	157 ·2	71·75	50·97	49·38	20·01
Mesitylol,	C_9H_{12}	120	162 ·7	71·75	52·28	50 01	19·76
Pseudocumol,	C_9H_{12}	120	168	72·80	52·57	50·62	19·81
Cymol,	$C_{10}H_{14}$	134	175	66·30	59·82	57·43	19·83
Citron oil,	$C_{10}H_{16}$	136	176 ·1	70·02	56·74	58·42	21·20
Terebene,	$C_{10}H_{16}$	136	156	67·21	54·11	55·80	21·30
Chloroform,	$CHCl_3$	119 1	60 ·9	58·49	37·66	38·04	20·87
Methyl iodide,	CH_3I	141·5	42 ·2	46·07	42·71	42·66	20·68
Methylene chloride,	CH_2Cl_2	84·7	41 ·6	75·40	25·94	25·49	20·30
Ethyl bromide,	C_2H_5Br	109	38 ·2	60·37	31·69	32·49	21·14
,, chloride,	C_2H_5Cl	64·4	21 ·17	89·30	19·15	18·12	19·89
Ethylene chloride,	$C_2H_4Cl_2$	98·7	58	66·30	32·65	31·25	19·77
Ethyl iodide,	C_2H_5I	155·5	71 ·3	46·87	49·97	51·21	21·17
Diethylamine,	$NH(C_2H_5)_2$	73	58	91	23·79	23·11	20·07
Ether,	$(C_2H_5)_2O$	74	34 ·83	84·50	22·16	21·78	20·31
Ethylene oxide,	C_2H_4O	44	13 ·5	138·64	11·68	12·06	21·29
Methylal,	$C_3H_8O_2$	76	42	89·87	21·82	22·90	21·68
Chloral,	CCl_3COH	147·1	97 ·2	54·10	50·06	51·09	21·22
Ethyl formate,	$HCOOC_2H_5$	74	53 ·5	92·20	22·85	23·11	20·89
Propyl ,,	$HCOOC_3H_7$	88	81 ·2	85·25	29·08	29·81	21·18
i-Butyl ,,	$HCOOC_4H_9$	102	98	77	35·32	36·19	21·17
i-Amyl ,,	$HCOOC_5H_{11}$	116	124	71·65	43·19	44·05	20·93
Methyl acetate,	CH_3COOCH_3	74	57 ·3	93·95	22·94	23·38	21·05
Ethyl ,,	$CH_3COOC_2H_5$	88	77	83·07	29·14	29·46	20·88
Propyl ,,	$CH_3COOC_3H_7$	102	102 ·3	77·30	36·00	36·61	21·01
i-Butyl ,,	$CH_3COOC_4H_9$	116	116 ·8	69·90	42·95	43·25	20·80
i Amyl ,,	$CH_3COOC_5H_{11}$	130	142	66·35	51·29	51·60	20·78
Methyl propionate,	$C_2H_5COOCH_3$	88	80	84·15	29·26	29·71	20·98

TABLE LXXIVD.—*continued.*

Solvent. Name.	Solvent. Molecular Formula.	Molecular Weight of Solvent.	T − 273.	λ	Value of E. $0{\cdot}01976\frac{T^2}{\lambda}$	Value of E. $0{\cdot}000565MT$	$\frac{M\lambda}{T}$
Ethyl propionate, ...	$C_2H_5COOC_2H_5$	102	98°·7	77·10	35·51	36·26	21·15
Propyl ,, ...	$C_2H_5COOC_3H_7$	116	122 ·6	71·50	43·25	43·89	20·96
i-Butyl ,, ...	$C_2H_5COOC_4H_9$	130	136 ·8	66	50·28	50·95	20·93
i-Amyl ,, ...	$C_2H_5COOC_5H_{11}$	144	160 ·5	63·05	58·89	59·71	21·09
Methyl butyrate, . . .	$C_3H_7COOCH_3$	102	102 ·3	77·25	36·03	36·61	20·99
Methyl *i*- ,, ...	,,	102	92 ·5	75·50	34·96	35·66	21·06
Ethyl ,, ...	$C_3H_7COOC_2H_5$	116	119	71·50	42·77	43·49	21·16
Ethyl *i*- ,, ...	,,	116	110	69·20	41·89	42·50	20·96
Propyl ,, ...	$C_3H_7COOC_3H_7$	130	143 ·6	66·2	51·80	51·80	20·66
Propyl *i*- ,, ...	,,	130	134	63·9	51·22	50·61	20·41
i-Butyl ,, ...	$C_3H_7COOC_4H_9$	144	156 ·7	61·9	58·94	59·18	20 70
i-Butyl *i*- ,, ...	,,	144	148 ·6	59·95	58·59	58·07	20·48
i-Amyl ,, ...	$C_3H_7COOC_5H_{11}$	158	178	59·4	67·66	68·16	20·81
i-Amyl *i*- ,, ...	,,	158	168	57·65	66·66	66·64	20 65
Methyl valerate, . . .	$C_4H_9COOCH_3$	116	116 ·3	69·95	42·81	43·19	20 84
Ethyl ,, ...	$C_4H_9COOC_2H_5$	130	134	64·65	50·73	50·61	20·65
Propyl ,, ...	$C_4H_9COOC_3H_7$	144	155 ·5	61·2	59·28	58·92	20·56
i-Butyl ,, ...	$C_4H_9COOC_4H_9$	158	169	57·85	66·73	66·82	20·68
i-Amyl ,, ...	$C_4H_9COOC_5H_{11}$	172	187 ·5	56·2	74·56	75·76	20·99

In the preceding list all the values for $\frac{M\lambda}{T}$ come within 5% on either side of the standard quantity 20·658: the values for the four following substances are very suggestive.

Solvent. Name.	Solvent. Molecular Formula.	Molecular Weight of Solvent.	T − 273.	λ	Value of E. $0{\cdot}01976\frac{T^2}{\lambda}$	Value of E. $0{\cdot}000565MT$	$\frac{M\lambda}{T}$
Methyl chloride, ...	CH_3Cl	50·4	−23°·7	48·6	25·27	12·02	9·825
,, ,, ...	$C_2H_6Cl_2$	100·8	−23 ·7	48·6	25·27	24·04	19·65
Ethylene bromide, . . .	$C_2H_4Br_2$	188	111	82·3	35·40	69·05	40·29
,, ,, ...	CH_2Br	94	111	82·3	35·40	34·53	20·15
Hydrogen cyanide, . . .	HCN	27	26	57·1	30·94	7·72	5·156
,, ,, ...	$H_4C_4N_4$	108	26	57·1	30·94	30·08	20·62
Chloral hydrate, . . .	$C_2H_3Cl_3O_2$	165·1	96 ·5	132·3	20·39	58·35	59·11
,, ,, ...	$\frac{1}{3}(C_2H_3Cl_3O_2)$	55·03	95 ·5	132·3	20·39	19·45	19·70

Water and the alcohols give seemingly abnormal values for $\frac{M\lambda}{T}$, as will be seen below; so also do some of the ethers, etc.

Solvent. Name.	Solvent. Molecular Formula.	Molecular Weight of Solvent.	T − 273.	λ	Value of E. $0{\cdot}01976\frac{T^2}{\lambda}$	Value of E. 0·000965MT	$\frac{M\lambda}{T}$
Water,	H_2O	18	100°	535·9	5·13	6·42	25·86
Methyl alcohol,	CH_3OH	32	64 ·5	267·48	8·41	10·33	25·36
Ethyl ,,	C_2H_5OH	46	78 ·1	205·07	11·88	15·45	25·86
Propyl ,, (normal),	C_3H_7OH	60	97 ·4	159·54	17·02	21·26	25·82
i-Butyl ,,	C_4H_9OH	74	108 ·4	132·68	21·66	27·00	25·74
Amyl ,,	$C_5H_{11}OH$	88	131	120	26·87	34·00	26·14
,, ,, (tertiary),	$C_5H_{11}OH$	88	102	105·455	26·35	31·56	24·75
Cetyl ,,	$C_{16}H_{33}OH$	242	344	58·48	128·66	142·82	22·93
Amyl ether,	$(C_5H_{11})_2O$	158	176	69·4	57·40	67·86	24·42

For the organic acids, etc., the anomalies are greater and, perhaps, more inexplicable, as will be seen from the following examples:—

Solvent. Name.	Solvent. Molecular Formula.	Molecular Weight of Solvent.	T − 273	λ	Value of E. $0{\cdot}01976\frac{T^2}{\lambda}$	Value of E. 0·000965MT	$\frac{M\lambda}{T}$
Hydrogen formate,	HCOOH	46	100°·6	103·7	26·61	16·44	12·79
,, acetate,	CH_3COOH	60	118	84·9	35·58	22·44	13·03
,, butyrate,	C_3H_7COOH	88	164	114	33·10	36·78	22·96
,, valerate,	C_4H_9COOH	102	184	103·52	41·75	44·58	23·10
Acetic anhydride,	$(C_2H_3O)_2O$	102	137	66·1	50·25	40·00	16·44
Methyl formate,	$HCOOCH_3$	60	32 ·9	117·1	15·79	17·65	22·96
Acetone,	CH_3COCH_3	58	56 ·6	125·8	17·13	18·29	22·45

It rarely happens that anything stronger than a 1 per cent. solution gives reliable results, and the vapour tension of the dissolved substance at the boiling temperature of the solvent should be very slight.

Ostwald gives the following values for—

	100 E.		100 E.
Water,	520	Ethyl acetate,	2610
Ethyl alcohol,	1150	Benzol,	2670
Acetone,	1670	Phenol,	3040
Ethylic ether,	2110	Aniline,	3220
Carbon disulphide,	2370	Chloroform,	3660
Hydrogen acetate,	2530	Ethylene bromide,	6320

These are identical with the values given by Beckmann, *Zeitschr. f. physik. Chem.*, iv. 533, etc.

The variation of the atmospheric pressure complicates this method very largely, and, whenever available, the freezing point method is to be preferred.

The following table, arranged from G. Tammann's investigations, is very suggestive as to the effect of higher concentration on the vapour pressure of aqueous solutions.

TABLE LXXIVE.

Diminution of Vapour Pressure of Water at 100° C. caused by dissolving n gramme molecules of various salts in 1 kilogramme of water; diminution of pressure given in millimetres of ice-cold mercury.

Substance dissolved.		n.								
Name.	Formula.	0·5	1	2	3	4	5	6	8	10
Sodium fluoride, ...	NaF	11·4	23·0							
Potassium ,, . . .	KF	10·6	22·3	46·0	75·0	106·0	136·5	166·8	233·0	
Lithium chloride, . . .	$LiCl$	12·1	25·5	57·1	95·0	132·5	175·5	219·5	311·5	393·5
Sodium ,, . . .	$NaCl$	12·3	25·2	52·1	80·0	111·0	143·0	176·5		
Potassium ,, . . .	KCl	12·2	24·4	48·8	74·1	100·9	128·5	152·2		
Rubidium ,, . . .	$RbCl$	12·2	24·6	50·0	76·5	101·0	128·5	156·0	203·5	247·0
Ammonium ,, . . .	NH_4Cl	12·0	23·7	45·1	69·3	94·2	118·5	138·2	179·0	213·8
Hydroxylamine chloride, . .	NH_3OHCl	11·2	22·0	45·0	69·0	90·0	110·0			
Methylamine hydrochloride, .	NH_3CH_3Cl	9·4	20·0	43·0	68·0	92·0	114·3	137·0	180·0	218·0
Dimethylamine ,, . .	$NH_2(CH_3)_2Cl$	9·6	19·5	41·8	65·0	91·8	116·3	142·0	186·8	230·3
Trimethylamine ,, . .	$NH(CH_3)_3Cl$	7·0								
Tetramethyl ammonium chloride,	$N(CH_3)_4Cl$	11·1	22·0	49·0	76·2	106·1	134·9	163·5	219·3	275·2
Ethylamine hydrochloride, . .	$NH_3C_2H_5Cl$	9·9	15·8	39·0	62·7	85·0	107·9	129·1		
Diethylamine ,, . .	$NH_2(C_2H_5)_2Cl$	7·9								
Triethylamine ,, . .	$NH(C_2H_5)_3Cl$	6·5								
Aniline ,, . .	$NH_3C_6H_5Cl$	10·6	20·4	39·0	57·0	73·8	88·6	101·0		
Guanidin ,, . .	$CNH(NH_2)_2HCl$	11·6	22·2	42·0	61·8	80·9	99·5	118·0	152·0	185·0
Beryllium chloride, . . .	$BeCl_2$	17·4	43·2	110·5	195·5	291·1	368·7			
Magnesium ,, . . .	$MgCl_2$	16·8	39·0	100·5	183·3	277·0	377·0			
Calcium ,, . . .	$CaCl_2$	17·0	39·8	95·3	166·6	241·5	319·5			
Strontium ,, . . .	$SrCl_2$	16·8	38·8	91·4	156·8	223·3	281·5			
Barium ,, . . .	$BaCl_2$	16·4	36·7	77·6						
Manganese ,, . . .	$MnCl_2$	15·0	34·0	76·0	122·3	167·0	209·0			
Iron ,, . . .	$FeCl_2$	16·7	36·8	86·3	139·0	195·0	247·2	298·0		
Nickel ,, . . .	$NiCl_2$	16·1	37·0	86·7	147·0	212·8				
Cobalt ,, . . .	$CoCl_2$	15·0	34·8	83·0	136·0	186·4				

TABLE LXXIVE.—*continued.*

Substance dissolved.		*n.*								
Name.	Formula.	0·5	1	2	3	4	5	6	8	10
Zinc chloride, ...	$ZnCl_2$	9·2	18·7	46·2	75·0	107·0	153 0	195·0		
Cadmium chloride, . . .	$CdCl_2$	9·6	18·8	36·7	57·0	77·3	99·0			
Aluminium ,, . . .	$AlCl_3$	22·5	61·0	179·0	318·0					
Cerium ,, . . .	$CeCl_3$	21·6	52·8	137·0	229·0					
Lithium bromide, . . .	$LiBr$	12·2	26·2	60·0	97·0	140·0	186·3	241·5	341·5	438·0
Sodium ,, . . .	$NaBr$	12·6	25·9	57·0	89·2	124·2	159·5	197·5	268·0	
Potassium ,, . . .	KBr	12·0	24·2	50·8	76·5	105·5	132·8	160·0		
Ammonium ,, . . .	NH_4Br	11·9	23·9	48·8	74·1	99·4	121·5	145·5	190·2	228·5
Beryllium ,, . . .	$BeBr_2$	17·8	45·0	125·2	227·5	329·0				
Magnesium ,, . . .	$MgBr_2$	17·9	44·0	115·8	205·3	298·5				
Calcium ,, . . .	$CaBr_2$	17·7	44·2	105·8	191·0	283·3	368·5			
Strontium ,, . . .	$SrBr_2$	17·8	42·0	101·1	179·0	267·0				
Barium ,, . . .	$BaBr_2$	16·8	38·8	91·4	150·0	204·7				
Cadmium ,, . . .	$CdBr_2$	8·6	17·8	36·7	55·7	80·0				
Lithium iodide, . . .	LiI	13·6	28·6	64·7	105·2	154·5	206·0	264·0	357·0	445·0
Sodium ,, . . .	NaI	12·1	25·6	60·2	99·5	136·7	177·5	221·0	301 5	370·0
Potassium ,, . . .	KI	12·5	25·3	52·2	82·6	112·2	141·5	171·8	225 5	278·5
Ammonium ,, . . .	NH_4I	12·5	25·1	49·8	78·5	104·5	132·3	156·0	200·0	243·5
Cadmium ,, . . .	CdI_2	7·6	14·8	33·5	52·7					
Mercuric cyanide, . . .	$Hg(CN)_2$	6·4	12·1							
Sodium thiocyanate, . . .	$NaCNS$	11·6	24·6	55·7	89·2	122·0	156·2	195·0	256·2	314·0
Potassium ,, . . .	$KCNS$	10·8	22·8	48·8	76·0	105·0	128·5	152·8	200·2	241·0
Ammonium ,, . . .	NH_4CNS	10·8	22·0	46·0	68·6	93·0	117·5	140·0	179·5	218·0
Potassium ferrocyanide, . .	$K_4Fe(CN)_6$	16·6	37·0							
Ammonium borofluoride, . .	NH_4BF_4	10·5	22·2	45·0	67·0	93·5				
Barium ,, . .	$Ba(BF_4)_2$	17·5								
Lithium silicofluoride, . . .	Li_2SiF_6	15·4	34·0	70·0	106·0					
Ammonium ,, . . .	$(NH_4)_2SiF_6$	11·5	25·0	44·5						
Lithium hydroxide, . . .	$LiHO$	15·9	37·4							

Sodium hydroxide, . . .	$NaHO$	11·8	22·8	48·2	77·3	107·5	139·1	172·5	243·3	314·0
Potassium ,, . . .	KHO	15·0	29·5	64·0	99·2	140·0	181·8	223·0	309·5	387·8
Barium ,, . . .	$Ba(HO)_2$	12·3	22·5	39·0						
Sodium nitrite, ...	$NaNO_2$	11·6	24·4	50·0	75·0	98·2	122·5	146·5	189·0	226·2
Potassium ,, ...	KNO_2	11·1	22·8	44·8	67·0	90·0	110·5	130·7	167·0	198·8
Lithium nitrate, ...	$LiNO_3$	12·2	25·9	55·7	88·9	122·2	155·1	188·0	253·4	309·2
Sodium ,, ...	$NaNO_3$	10·6	22·5	46·2	68·1	90·3	111·5	131·7	167·8	198·8
Potassium nitrate, . . .	KNO_3	10·3	21·1	40·1	57·6	74·5	88·2	102·1	126·3	148·0
Rubidium ,, . . .	$RbNO_3$	10·9	22·1	42·1	58·2	73·8	89·2			
Ammonium ,, . . .	NH_4NO_3	12·8	22·0	42·1	62·7	82·9	103·8	121·0	152·2	180·0
Phenyl-ammonium nitrate, . .	$NH_3C_6H_5NO_3$	9·9	18·5	34·8	48·5	60·0	71·5	82·4	102·8	
Beryllium nitrate, . . .	$Be(NO_3)_2$	16·5								
Magnesium ,, . . .	$Mg(NO_3)_2$	17·6	42·0	101·0	174·8					
Calcium ,, . . .	$Ca(NO_3)_2$	16·4	34·8	74·6	139·3	161·7	205·4			
Strontium ,, . . .	$Sr(NO_3)_2$	15·8	31·0	64·0	97·4	131·4				
Barium ,, . . .	$Ba(NO_3)_2$	13·5	27·0							
Nickel ,, . . .	$Ni(NO_3)_2$	16·1	37·3	91·3	156·2	235·0				
Cobalt ,, . . .	$Co(NO_3)_2$	17·3	39·2	89·0	152·0	218·7	282·0	332·0		
Zinc ,, . . .	$Zn(NO_3)_2$	16·6	39·0	93·5	157·5	223·8				
Cadmium ,, . . .	$Cd(NO_3)_2$	15·9	36·1	78·0	122·2					
Lead ,, . . .	$Pb(NO_3)_2$	12·3	23·5	45·0	63·0					
Uranyl ,, . . .	$UO_2(NO_3)_2$	18·4								
Sodium chlorate, ...	$NaClO_3$	10·5	23·0	48·4	73·5	98·5	123·3	147·5	196·5	223·5
Potassium ,, ...	$KClO_3$	10·6	21·6	42·8	62·1	80·0				
Barium ,, ...	$Ba(ClO_3)_2$	15·8	33·3	70·5	108·2					
Cadmium ,, ...	$Cd(ClO_3)_2$	17·5								
Potassium perchlorate, . . .	$KClO_4$	11·5	22·3							
Sodium bromate, . . .	$NaBrO_4$	12·1	25·0	54·1	81·3	108·8	136·0			
Potassium ,, . . .	$KBrO_4$	10·9	22·4	45·0						
Sodium carbonate, . . .	Na_2CO_3	14·3	27·3	53·5	80·2	111·0				
Potassium ,, . . .	K_2CO_3	14·4	31·0	68·3	105·5	152·0	209·0	258·5	350·0	
Hydrogen sulphate, . . .	H_2SO_4	12·9	26·5	62·8	104·0	148·0	198·4	247·0	343·2	
Lithium-hydrogen sulphate, . .	$LiHSO_4$	12·8	27·0	57·0	93·0	130·0	168·0			
Sodium ,, ,, .	$NaHSO_4$	10·9	22·1	47·3	75·0	100·2	126·1	148·5	189·7	231·4
Potassium ,, ,, .	$KHSO_4$	10·9	21·9	43·3	65·3	85·5	107·8	129·2	170·0	
Rubidium ,, ,, .	$RbHSO_4$	10·9	21·9	43·0	63·6	83·8	104·0			

TABLE LXXIVE.—*continued.*

Ammonium hydrogen sulphate, .	NH_4HSO_4	11·5	22·0	46·8	71·0	94·5	118·0	139·0	181·2	218·0
Magnesium ,, ,, .	$MgH_2(SO_4)_2$	18·3	46·0	116·0						
Uranyl ,, ,, .	$UO_2H_2(SO_4)_2$	13·3	44·0	109·0						
Lithium sulphate, . . .	Li_2SO_4	13·3	28·1	56·8	89·0					
Sodium ,, . . .	Na_2SO_4	12·6	25·0	48·9	74·2					
Potassium ,, . . .	K_2SO_4	13·7	26·7							
Rubidium ,, . . .	Rb_2SO_4	14·6	28·3	57·8	86·8					
Ammonium ,, . . .	$(NH_4)_2SO_4$	11·0	24·0	46·5	69·5	93·0	117·0	141·8		
Beryllium ,, . . .	$BeSO_4$	5·3	12·5	27·5	52·0	85·0	123·0	161·0		
Magnesium ,, . . .	$MgSO_4$	6·5	12·0	24·5	47·5					
Manganese ,, . . .	$MnSO_4$	6·0	10·5	21·0						
Ferrous ,, . . .	$FeSO_4$	5·8	10·7	24·0	42·4					
Nickel ,, . . .	$NiSO_4$	5·0	10·2	21·5						
Cobalt ,, . . .	$CoSO_4$	5·5	10·7	22·9	45·5					
Copper ,, . . .	$CuSO_4$	6·0	12·5	27·7	48·5					
Zinc ,, . . .	$ZnSO_4$	4·9	10·4	21·5	42·1	66·2				
Cadmium ,, . . .	$CdSO_4$	4·1	8·9	18·1						
Uranyl ,, . . .	UO_2SO_4	4·1	10·4	23·2	40·8	64·0				
Aluminium ,, . . .	$Al_2(SO_4)_3$	12·8	36·5							
,, ammonium sulphate, .	$Al_2(NH_4)_2(SO_4)_4$	24·1	56·0							
Sodium thiosulphate, . . .	$Na_2S_2O_3$	14·1	29·5	62·1	97·0	137·0	177·7	215·6	278·0	
Potassium ,, . . .	$K_2S_2O_3$	13·7	26·0	53·5	83·0	113·8	144·6	175·5	235·0	
Lithium dithionate, . . .	$Li_2S_2O_6$	15·4	36·5	91·0	158·0	225·0				
Sodium ,, . . .	$Na_2S_2O_6$	13·5	29·5	63·5	100·5					
Potassium ,, . . .	$K_2S_2O_6$	12·1	24·0	46·0						
Ammonium ,, . . .	$(NH_4)_2S_2O_6$	13·2	28·2	59·0	91·0	120·0				
Calcium ,, . . .	CaS_2O_6	9·9	23·0	56·0	106·0					
Strontium ,, . . .	SrS_2O_6	7·2	10·3	47·0						
Barium ,, . . .	BaS_2O_6	6·6	15·4	34·4						

Lithium chromate, ...	Li_2CrO_4	16·4	32·6	74·0	120·0	171·0				
Sodium ,, ...	Na_2CrO_4	14·5	30·0	65·8	105·0	146·0				
Potassium ,, ...	K_2CrO_4	16·2	29·5	60·0						
Sodium molybdate, . . .	Na_2MoO_4	16·6	33·2	70·8	119·0	169·2	216·0			
Potassium ,, ...	K_2MoO_4	14·1	31·6	70·0	117·6	164·6	213·0			
Sodium tungstate, . . .	Na_2WO_4	14·8	33·6	71·6	115·7	162·6				
Potassium ,, ...	K_2WO_4	13·9	33·0	75·0	123·8	175·4	226·4			
Sodium paratungstate, . . .	$Na_2W_4O_{13}$	12·1	20·3	51·8	106·5					
Borax, ...	$Na_2B_4O_7$	20·7	33·8	54·0						
Hydrogen borate, . . .	H_3BO_3	6·0	12·3	25·1	38·0	51·0				
,, phosphate, . . .	H_3PO_4	6·6	14·0	28·6	45·2	62·0	81·5	103·0	146·9	189·5
Monosodic ,, . . .	NaH_2PO_4	10·5	20·0	36·5	51·7	66·8	82·0	96·5	126·7	157·1
Disodic ,, . . .	Na_2HPO_4	12·1	23·5	43·0	60·0	78·7	99·8	122·1		
Trisodic ,, . . .	Na_3PO_4	16·5	30·0	52·5						
Monopotassic ,, . . .	KH_2PO_4	10·2	19·5	33·3	47·8	60·5	73·1	85·2		
Sodium pyrophosphate, . .	$Na_4P_2O_7$	13·2	22·0							
,, trimetaphosphate, . .	$Na_3P_3O_9$	17·1	36·5							
,, hexametaphosphate, .	$Na_6P_6O_{18}$	11·6								
Hydrogen arsenate, . . .	H_3AsO_4	7·3	15·0	30·2	46·4	64·9				
Monosodic ,, . . .	NaH_2AsO_4	11·3	20·6	38·8	57·0	74·9	92·8			
Disodic ,, . . .	NaH_2AsO_4	14·3	26·5	50·7	75·8					
Monopotassic ,, . . .	KH_2AsO_4	10·9	20·0	37·2	54·0	69·5				
Sodium phenolsulphonate (*p*), .	$C_6H_4.OH.SO_3Na$	11·8	22·6	49·8	75·5	104·5				
Barium ,, .	$(C_6H_4.OH.SO_3)_2Ba$	14·5								
,, benzene-sulphonate, .	$(C_6H_5SO_3)_2Ba$	14·2	.							
Sodium formate, ...	HCOONa	12·9	24·1	48·2	77·6	102·2	127·8	152·0	198·0	239·4
Potassium ,, ...	HCOOK	11·6	23·6	59·0	77·6	104·2	132·0	160·0	210·0	255·0
Sodium acetate, ...	CH_3COONa	11·5	26·0	52·0	83·0	113·4	143·0	173·0	227·0	278·0
Potassium ,, ...	CH_3COOK	12·4	24·0	54·6	86·0	119·0	152·0	186·2	250·0	307·0
Barium ,, ...	$(CH_3COO)_2Ba$	14·6								
Lead ,, ...	$(CH_3COO)_2Pb$	8·0	14·1	23·3	33·0	41·8	50·2	59·3		
Hydrogen glycollate, . . .	$CH_2OH.COOH$	7·0	14·0	26·5	39·2	50·0				
Sodium propionate, . . .	C_2H_5COONa	10·9	22·6	46·2	71·4	97·4	122·2	146·0	189·0	232·0
Potassium ,, ...	C_2H_5COOK	12·3	24·0	53·0	84·8	116·8	148·0	181·0	234·0	288·4
Calcium ,, ...	$(C_2H_5COO)_2Ca$	13·8								
Barium ,, ...	$(C_2H_5COO)_2Ba$	13·9								

TABLE LXXIVE.—*continued.*

Substance dissolved.		*n.*								
Name.	Formula	0·5	1	2	3	4	5	6	8	10
Sodium butyrate,	C_3H_7COONa	12·5	26·0	53·0	81·6	108·2	131·0	153·6	193·0	230·0
Potassium ,,	C_3H_7COOK	12·4	24·0	54·4	84·0	113·4	141·0	169·0	219·0	266·0
Sodium isobutyrate,	C_3H_7COONa	11·8	24·0	52·0	81·6	108·4	133·4	158·0	200·4	237·0
Potassium ,,	C_3H_7COOK	12·2	24·0	52·2	80·4	110·0	139·0	167·4	218·0	266·0
Sodium valerate,	C_4H_9COONa	11·4	24·0	51·0	73·8	96·0	114·8	132·0	164·0	199·0
Potassium ,,	C_4H_9COOK	11·5	22·0	49·6	74·4	99·8	122·4	145·6	190·0	230·6
Hydrogen lactate,	$C_2H_4.OH\ COOH$	6·5	12·4	24·0	34·3	44·7	55·0	65·6	88·0	110·6
Calcium ,,	$(C_2H_4.OH.COO)_2Ca$	10·4								
Sodium benzoate,	C_6H_5COONa	11·2	23·0	44·2	65·0	86·0	103·0			
Potassium ,,	C_6H_5COOK	12·2	22·0	48·2	72·4	96·0	118·8	142·0		
Hydrogen succinate,	$C_2H_4(COOH)_2$	6·2	12·4	24·8	36·7	48·5	59·7	71·2	94·1	
Sodium ,,	$C_2H_4(COONa)_2$	16·7	34·5	76·2	122·5	165·6				
Potassium ,,	$C_2H_4(COOK)_2$	16·7	36·0	80·5	130·1	180·9	230·5			
Hydrogen malate,	$C_2H_3OH(COOH)_2$	6·6	13·5	27·4	44·0	59·7	75·8	91·6	124·9	166·5
,, racemate,	$C_2H_2(OH)_2(COOH)_2$	7·8	15·4	32·3	48·3	66·9	86·5	106·2	151·0	
,, tartrate,	$C_2H_2(OH)_2(COOH)_2$	6·9	14·3	30·0	47·7	66·8	86·4	103·1	135·0	167·8
Sodium ,,	$C_2H_2(OH)_2(COONa)_2$	14·7	28·7	58·0	83·0	110·0	132·0	153·0		
Potassium ,,	$C_2H_2(OH)_2(COOK)_2$	14·6	29·5	60·1	92·0	126·0	157·9	188·0		
Tartar emetic,	$C_2H_2(OH)_2\langle{}^{COOK}_{COOSbO}$	27·1								
Potassium malonate,	$CH_2(COOK)_2$	13·4								
,, oxalate,	$K_2C_2O_4$	13·9	28·3	59·8	94·2	131·0				
Hydrogen citrate,	$C_3H_4OH(COOH)_3$	7·9	15·0	31·8	50·0	71·1	92·8			
Sodium ,,	$C_3H_4OH(COONa)_3$	16·2	35·7	75·0	119·2					
Potassium ,,	$C_3H_4OH(COOK)_3$	16·9	37·9	89·7	140·5	205·4	258·2			

TABLE LXXIVF.

Prof. Ramsay, from observations on the diminution of vapour pressure of mercury, obtained the following results for the various metals:—

	Molecular Weight calculated.	Atomic Weight O=16.		Molecular Weight calculated.	Atomic Weight O=16.
Li	7·1	7·03	Al	33·1 - 36·7	27·1
Na	21·6 - 15·1	23·05	Ga	69·7	70
K	30·2 - 29·1	39·15	Sb	136 - 301	120·2
Mg	24·0 - 21·5	24·36	Tl	197·6 - 163·6	204·1
Ca	19·1	40·1	Bi	214 - 232	208·5
Ba	75·7	137·4	Sn	117·4 - 149·5	119·0
Mn	55·5	55·0	Pb	200 - 250	206·9
Zn	65·4 - 70·1	65·4	Ag	112·4	107·93
Cd	103·8 - 99·7	112·4	Au	207·4 - 208·1	197·2

The approximations, though not very close, indicate very emphatically that metals in mercurial solution tend to form monatomic molecules.

IV. **Distillation of Mixed Liquids.**

If a mixture of two liquids distils over at temperature T in proportion of $Q_1 : Q_2$, and if the vapour pressures of the two liquids at T are Π_1 and Π_2 respectively, and if d_1 and d_2 be the vapour densities of the two bodies,

$\because$ $Q_1 : Q_2 = \Pi_1 d_1 : \Pi_2 d_2$. (Gay-Lussac, Wanklyn, Berthelot, etc.)

Now, if the molecular weight of one ($\mathfrak{M}_1$) be known, that of the other can be easily calculated from Naumann's formula—

$$\mathfrak{M} = \frac{\mathfrak{M}_1 . Q_2 \Pi_1}{Q_1 \Pi_2}.$$

This formula assumes that the vapour density of each constituent of the mixture is normal at the temperature T, but such is never the case, and the method is at best only roughly approximate, and of more value as a contribution to chemical theory than as a working method. With such liquids as water, benzene, etc., whose vapour pressures are known for various temperatures, the vapour pressure (Π_2) of the other substance may be taken as = Barometric pressure − Π_1.

Naumann's formula is useful for calculating molecular weights from the results of steam distillations and other analogous operations, but the results are only roughly approximate. Better results may be obtained as follows:—

$$d_2 = \frac{d_1 Q_2 \Pi_1}{Q_1 \Pi_2},$$

where d_1 = density (here either weight of 1 litre, or "vapour density," referred to air or hydrogen) of the substance of known molecular weight at temperature T and under the pressure Π_1, and d_2 = corresponding value for the second substance under the pressure Π_2.

For example, taking the data used by Beilstein: In the steam distillation of naphthalin at 98°·2 C. (cor.) and barometric pressure of 733 (cor.), the distillate consisted of 49·4 grms. of water and 8·9 grms. of naphthalin.

Here Π = Tension of aqueous vapour at 98°·2 C. = 712·27 mms. (Table LIXA),

$\therefore \Pi_2 = 733 - 712{\cdot}27 = 20{\cdot}73$.

d_1 = Weight of 1 litre of water vapour at 98°·2 = 0·57043 grms. (Table LXVIIA),

$$\therefore d_2 = \frac{0{\cdot}57043 \times 8{\cdot}9 \times 712{\cdot}27}{49{\cdot}4 \times 20{\cdot}73}.$$

Correcting to the standard pressure of 1 metre of ice-cold mercury, we get the density the hypothetical vapour of naphthalin at 98°·2 C. under 1000 mms. pressure

$$= \frac{0{\cdot}57043 \times 8{\cdot}9 \times 1000}{49{\cdot}4 \times 20{\cdot}73} = 4{\cdot}9575.$$

According to Table LXIE. the molecular volume at 98°·2 C. is 23·070056, and consequently molecular weight of naphthalin

$$= 4{\cdot}9575 \times 23{\cdot}070056 = 114{\cdot}37;$$

or using Naumann's formula

$$\mathfrak{M} = \frac{18{\cdot}016 \times 8{\cdot}9 \times 712{\cdot}27}{49{\cdot}4 \times 20{\cdot}73} = 111{\cdot}52.$$

PART IV.—ANALYTICAL CHEMISTRY.

In the following tables every possible precaution has been taken to ensure the strictest accuracy, and it is hoped that errors which have escaped detection are, at the very worst, few and insignificant. The factors, multiples, logarithms, etc., have been calculated to as many decimal places as the author deemed necessary for the very finest analytical work; for ordinary work, technical and commercial, considerably fewer decimals will suffice.

The values for the atomic weights adopted in the calculation of these tables are those given by the International Committee at the commencement of the year 1904, the standard being O≡16. As far as the more important elements are concerned, these values are likely to remain unaltered, and only those for the most rare and recently discovered substances are at all likely, at anything like a moderately early date, to undergo any appreciable modifications. As far as the ordinary daily routine of commercial and technical work is concerned, the author ventures to hope that these tables may prove of permanent value.

TABLE LXXVA.—Table for Computing the Results of Analyses.

Element.	Found.	Sought.	Logarithm of (Factor × 100).	Factor multiplied by								
				1	2	3	4	5	6	7	8	9
Aluminium	Al_2O_3	Al_2	1·7245482	0·530333	1·060665	1·590998	2·121331	2·651663	3·181996	3·712329	4·242661	4·772994
		Al_2Br_6	2·7180578	5·224658	10·449315	15·673973	20·898630	26·123288	31·347945	36·572603	41·797260	47·021918
		Al_2Cl_6	2·4168977	2·611546	5·223092	7·834638	10·446184	13·057730	15·669276	18·280822	20·892368	23·503914
		$Al_2(SO_4)_3$	2·5250575	3·350098	6·700196	10·050294	13·400391	16·750489	20·100587	23·450685	26·809783	30·150881
		$Al_2(SO_4)_3 + 18H_2O$	2·8144587	6·523170	13·046341	19·569511	26·092681	32·615851	39·139022	45·662192	52·185362	58·708532
		$K_2Al_2(SO_4)_4 + 24H_2O$	2·9678720	9·286928	18·573855	27·860783	37·147710	46·434638	55·721566	65·008493	74·295421	83·582348
	$Al_2P_2O_8$	Al_2	1·3462536	0·221949	0·443898	0·665848	0·887797	1·109746	1·331695	1·553645	1·775594	1·997543
		Al_2O_3	1·6217052	0·418509	0·837019	1·255528	1·674038	2·092547	2·511057	2·929566	3·348075	3·766585
Antimony	Sb_2O_4	Sb_2	1·8974899	0·789750	1·579501	2·369251	3·159001	3·948752	4·738502	5·528252	6·318003	7·107753
		Sb_2O_3	1·9765507	0·947438	1·894875	2·842313	3·789750	4·737188	5·684625	6·632063	7·579501	8·526938
		Sb_2O_5	2·0222479	1·052562	2·105125	3·157687	4·210250	5·262812	6·315374	7·367937	8·420499	9·473062
		Sb_2S_3	2·0436437	1·105716	2·211432	3·317148	4·422865	5·528581	6·634297	7·740013	8·845729	9·951445
		Sb_2S_5	2·1193747	1·316360	2·632720	3·949080	5·265440	6·581800	7·898160	9·214520	10·530880	11·847240
		$K_2Sb_2O_2(C_4H_4O_6)_2 + H_2O$	2·3392333	2·183903	4·367806	6·551708	8·735611	10·919514	13·103317	15·287219	17·471122	19·655025
	Sb_2O_3	Sb_2	1·9209392	0·833564	1·667129	2·500693	3·334258	4·167822	5·001387	5·834951	6·668516	7·502080
		Sb_2S_3	2·0670930	1·167060	2·334119	3·501179	4·668239	5·835298	7·002358	8·169417	9·336477	10·503537
	Sb_2O_5	Sb_2	1·8752420	0·750312	1·500624	2·250936	3·001248	3·751561	4·501873	5·252185	6·002497	6·752809
		Sb_2S_3	2·0213958	1·050499	2·100999	3·151498	4·201997	5·252497	6·302996	7·353496	8·403995	9·454494
	Sb_2S_3	Sb_2	1·8538452	0·714243	1·428487	2·142730	2·856973	3·571216	4·285460	4·999703	5·713946	6·428199
		Sb_2O_3	1·9329070	0·856854	1·713708	2·570563	3·427417	4·284271	5·141135	5·997980	6·854834	7·711688
	Sb_2S_5	Sb_2	1·7781152	0·599950	1·199900	1·799850	2·399800	2·999750	3·599700	4·199651	4·799601	5·399551
		Sb_2S_3	1·9242690	0·839980	1·679960	2·519940	3·359920	4·199900	5·039880	5·879860	6·719840	7·559820
	$Na_2H_2Sb_2O_7$	Sb_2	1·7783146	0·600226	1·200451	1·800677	2·400903	3·001129	3·601354	4·201580	4·801806	5·402031
		Sb_2S_3	1·9244684	0·840366	1·680732	2·521098	3·361464	4·201830	5·042196	5·882561	6·722927	7·563293
	$C_6H_2(OH)_3COO(SbO)$	Sb_2	1·5952631	0·393788	0·787577	1·181365	1·575154	1·968942	2·362731	2·756519	3·150308	3·544096
		Sb_2S_3	1·7414169	0·551337	1·102673	1·654010	2·205347	2·756683	3·308020	3·859357	4·410693	4·962030
Arsenic	As_4S_6	As_4	1·7848385	0·609310	1·218621	1·827931	2·437241	3·046551	3·655862	4·265172	4·874482	5·483792
		As_4O_6	1·9054124	0·804290	1·608579	2·412869	3·217158	4·021448	4·825737	5·630027	6·434316	7·238606
		As_2O_5	1·9704750	0·934276	1·868551	2·802827	3·737103	4·671379	5·605654	6·539930	7·474206	8·408482
		As_2S_5	2·1005290	1·260460	2·520920	3·781379	5·041839	6·302299	7·562759	8·823219	10·083679	11·344138
	As_4O_6	As_4	1·8794261	0·757576	1·515152	2·272727	3·030303	3·787879	4·545455	5·303030	6·060606	6·818182
		As_2O_5	2·0650626	1·161616	2·323232	3·484848	4·646465	5·808081	6·969697	8·131313	9·292929	10·454545
		As_4S_6	2·0945876	1·243333	2·486667	3·730000	4·973333	6·216667	7·460000	8·703333	9·946667	11·190000

TABLE LXXVa.—*continued.*

Element.	Found.	Sought.	Logarithm of (Factor × 100).	Factor multiplied by 1	2	3	4	5	6	7	8	9
Arsenic	As_2O_5	As_2S_5	2·1951166	1·567172	3·134343	4·701515	6·268687	7·835859	9·403030	10·970202	12·537374	14·104545
		As_4	1·8143635	0·652174	1·304348	1·956522	2·608696	3·260870	3·913043	4·565217	5·217391	5·869565
		As_4O_6	1·9349374	0·860870	1·721739	2·582609	3·443478	4·304348	5·165217	6·026087	6·886956	7·747826
		As_4S_6	2·0295250	1·070348	2·140696	3·211043	4·281391	5·351739	6·422087	7·492435	8·562783	9·633130
		As_2S_5	2·1300540	1·349130	2·698261	4·047391	5·396522	6·745652	8·094783	9·443913	10·793043	12·142174
	$MgNH_4AsO_4)_2+H_2O$	As_4	1·5953031	0·393825	0·787650	1·181474	1·575299	1·969124	2·362949	2·756774	3·150599	3·544423
		As_4O_6	1·7158770	0·519849	1·039698	1·559546	2·079395	2·599244	3·119093	3·638941	4·158790	4·678639
		As_4S_6	1·8104646	0·646345	1·292691	1·939036	2·585381	3·231727	3·878072	4·524417	5·170762	5·817108
		As_2O_5	1·7809396	0·603865	1·207729	1·811594	2·415459	3·019324	3·623189	4·227053	4·830918	5·434783
	$MgNH_4AsO_4+6H_2O$	As_4	1·4133708	0·259042	0·518085	0·777127	1·036169	1·295211	1·554254	1·813296	2·072338	2·331381
		As_4O_6	1·5339447	0·341936	0·683872	1·025808	1·367743	1·709679	2·051615	2·393551	2·735487	3·077423
		As_4S_6	1·6285323	0·425140	0·850280	1·275421	1·700561	2·125701	2·550841	2·975982	3·401122	3·826262
		As_2O_5	1·5990073	0·397198	0·794396	1·191595	1·588793	1·985991	2·383189	2·780387	3·177586	3·574784
	$Mg_2As_2O_7$	As_4	1·6837221	0·482750	0·965499	1·448249	1·930999	2·413749	2·896498	3·379248	3·861998	4·344748
		As_4O_6	1·8042960	0·637230	1·274459	1·911689	2·548919	3·186148	3·823378	4·460608	5·097837	5·735067
		As_4S_6	1·8988836	0·792289	1·584578	2·376867	3·169155	3·961444	4·753733	5·546022	6·338311	7·130600
		As_2O_5	1·8693586	0·740216	1·480433	2·220649	2·960865	3·701081	4·441298	5·181514	5·921730	6·661946
	$(UO_2)_2As_2O_7$	As_4	1·2713758	0·186799	0·373599	0·560399	0·747198	0·933998	1·120797	1·307597	1·494396	1·681196
		As_4O_6	1·3919497	0·246575	0·493151	0·739726	0·986301	1·232877	1·479452	1·726027	1·972603	2·219178
		As_4S_6	1·4865373	0·306575	0·613151	0·919726	1·226301	1·532877	1·839452	2·146027	2·452603	2·759178
		As_2O_5	1·4570123	0·286426	0·572852	0·859278	1·145704	1·432130	1·718555	2·004981	2·291407	2·577833
	$BiAsO_4$	As_4	1·3341065	0·215827	0·431655	0·647482	0·863309	1·079137	1·294964	1·510791	1·726619	1·942446
		As_4O_6	1·4546804	0·284892	0·569784	0·854676	1·139568	1·424460	1·709352	1·994245	2·279137	2·564029
		As_4S_6	1·5492680	0·354216	0·708432	1·062647	1·416863	1·771079	2·125295	2·479511	2·833727	3·187942
		As_2O_5	1·5197430	0·330935	0·661871	0·992806	1·323741	1·654676	1·985612	2·316547	2·647482	2·978417
	$Pb_3As_2O_8$	As_4	1·2224766	0·166908	0·333816	0·500723	0·667631	0·834539	1·001447	1·168354	1·335262	1·502170
		As_4O_6	1·3430505	0·220318	0·440636	0·660955	0·881273	1·101591	1·321909	1·542228	1·762546	1·982864
		As_4S_6	1·4376381	0·273929	0·547858	0·821787	1·095716	1·369645	1·643574	1·917503	2·191432	2·465361
		As_2O_5	1·4081131	0·255925	0·511850	0·767776	1·023701	1·279626	1·535551	1 791477	2·047402	2·303327
Barium	$BaSO_4$	Ba	1·7697742	0·588538	1·177075	1·765613	2·354151	2·942688	3·531226	4·119764	4·708301	5·296839
		BaO	1·8176129	0·657072	1·314144	1·971216	2·628287	3·285359	3·942431	4·599503	5·256575	5 913647
		$Ba(OH)_2$	1·8658389	0·734241	1·468483	2·202724	2·936966	3·671207	4·405448	5·139690	5·873931	6·608173
		$BaCO_3$	1·9271346	0·845541	1·691082	2·536623	3·382164	4·227705	5·073246	5·918787	6·764328	7·609869

		$BaCl_2$	1·9504768	0·892229	1·784458	2·676687	3·568916	4·461145	5·353374	6·245603	7·137831	8·030060
		$BaCl_2+2H_2O$	2·0197679	1·046569	2·093138	3·139707	4·186276	5·232845	6·279414	7·325983	8·372552	9·419121
		$Ba(NO_3)_2$	2·0492260	1·120021	2·240041	3·360062	4·480082	5·600103	6·720123	7·840144	8·960164	10·080185
	$BaCO_3$	Ba	1·8426396	0·696049	1·392097	2·088146	2·784195	3·480243	4·176292	4·872340	5·568389	6·264438
		BaO	1·8904783	0·777102	1·554205	2·331307	3·108409	3·885512	4·662614	5·439716	6·216819	6·993921
		$BaCl_2$	2·0233422	1·055218	2·110436	3·165653	4·220871	5·276089	6·331307	7·386525	8·441743	9·496960
	$BaCrO_4$	Ba	1·7340087	0·542012	1·084024	1·626035	2·168047	2·710059	3·252071	3·794083	4·336095	4·878106
		BaO	1·7818474	0·605128	1·210256	1·815385	2·420513	3·025641	3·630769	4·235897	4·841026	5·446154
		$BaCl_2$	1·9147123	0·821696	1·643393	2·465089	3·286785	4·108481	4·930177	5·751874	6·573570	7·395266
	$BaSiF_6$	Ba	1·6911390	0·491065	0·982130	1·473195	1·964260	2·455325	2·946390	3·437455	3·928520	4·419585
		BaO	1·7389777	0·548249	1·096497	1·644746	2·192995	2·741244	3·289492	3·837741	4·385990	4·934239
		$BaCl_2$	1·8718416	0·744460	1·488921	2·233381	2·977841	3·722302	4·466762	5·211222	5·955683	6·700143
	$BaCl_2$	Ba	1·8192974	0·659626	1·319251	1·978877	2·638502	3·298128	3·957753	4·617379	5·277004	5·936630
		BaO	1·8671361	0·736438	1·472876	2·209313	2·945751	3·682189	4·418627	5·155065	5·891503	6·627940
	$Ba(NO_3)_2$	Ba	1·7205482	0·525470	1·050941	1·576411	2·101882	2·627352	3·152822	3·678293	4·203763	4·729234
		BaO	1·7683869	0·586661	1·173321	1·759982	2·346642	2·933303	3·519963	4·106624	4·693284	5·279945
Beryllium	BeO	Be	1·5593677	0·362550	0·725100	1·087649	1·450199	1·812749	2·175299	2·537849	2·900398	3·262948
		$BeCl_2$	2·5034163	3·187251	6·374502	9·561753	12·749004	15·936255	19·123506	22·310757	25·498008	28·685259
		$BeSO_4+4H_2O$	2·8488488	7·060717	14·121434	21·182151	28·242869	35·303586	42·364303	49·425020	56·485737	63·546454
Bismuth	Bi	Bi_2O_3	2·0473169	1·115108	2·230216	3·345324	4·460432	5·575540	6·690647	7·805755	8·920863	10·035971
		Bi_2S_3	2·0901336	1·230647	2·461295	3·691942	4·922590	6·153237	7·383885	8·614532	9·845180	11·075827
	Bi_2O_3	Bi	1·9526831	0·896774	1·793548	2·690323	3·587097	4·483871	5·380645	6·277419	7·174194	8·070968
		Bi_2S_3	2·0428167	1·103613	2·207226	3·310839	4·414452	5·518065	6·621677	7·725290	8·828903	9·932516
	Bi_2S_3	Bi	1·9098664	0·812580	1·625161	2·437741	3·250322	4·062902	4·875482	5·688063	6·500643	7·313223
		Bi_2O_3	1·9571833	0·906115	1·812230	2·718344	3·624459	4·530574	5·436689	6·342804	7·248918	8·155033
	$BiAsO_4$	Bi	1·7781513	0·6	1·2	1·8	2·4	3·0	3·6	4·2	4·8	5·4
		Bi_2O_3	1·8254682	0·669065	1·338129	2·007194	2·676259	3·345324	4·014388	4·683453	5·352518	6·021583
		Bi_2S_3	1·8682849	0·738388	1·476777	2·215165	2·953554	3·691942	4·430331	5·168719	5·907108	6·645496
	BiOCl	Bi	1·9042163	0·802077	1·604155	2·406232	3·208309	4·010387	4·812464	5·614541	6·416619	7·218696
		Bi_2O_3	1·9515332	0·894403	1·788806	2·683208	3·577611	4·472014	5·366417	6·260819	7·155222	8·049625
		Bi_2S_3	1·9943499	0·987074	1·974149	2·961223	3·948298	4·935372	5·922447	6·909521	7·896595	8·883670
	$(BiO)_2Cr_2O_7$	Bi	1·7767787	0·598107	1·196213	1·794320	2·392427	2·990534	3·588640	4·186747	4·784854	5·382960
		Bi_2O_3	1·8240956	0·666954	1·333907	2·000861	2·667814	3·334768	4·001721	4·668675	5·335628	6·002582
		Bi_2S_3	1·8669123	0·736059	1·472117	2·208176	2·944234	3·680293	4·416351	5·152410	5·888468	6·624527
Boron	B_2O_3	B	1·4973247	0·314286	0·628571	0·942857	1·257143	1·571429	1·885714	2·200000	2·514286	2·828571
	KBF_4	B	0·9405054	0·087198	0·174396	0·261593	0·348791	0·435989	0·523187	0·610384	0·697582	0·784780
		B_2O_3	1·4431807	0·277447	0·554895	0·832342	1·109790	1·387237	1·664685	1·942132	2·219580	2·497027
Bromine	AgBr	Br	1·6289691	0·425568	0·851136	1·276704	1·702273	2·127841	2·553409	2·978977	3·404545	3·830113
		HBr	1·6344097	0·430933	0·861866	1·292799	1·723732	2·154665	2·585598	3·016531	3·447464	3·878397
		NaBr	1·7389757	0·548246	1·096493	1·644739	2·192985	2·741232	3·289478	3·837724	4·385970	4·934217

TABLE LXXVA.—*continued.*

Element.	Found.	Sought.	Logarithm of (Factor ×100).	Factor multiplied by 1	2	3	4	5	6	7	8	9
Bromine		KBr	1·8020445	0·633935	1·267869	1·901804	2·535739	3·169674	3·803608	4·437543	5·071478	5·705413
		Br_2O_3	1·7429626	0·553302	1·106605	1·659907	2·213210	2·766512	3·319815	3·873117	4·426420	4·979722
Cadmium	CdO	Cd	1·9422013	0·875389	1·750779	2·626168	3·501558	4·376947	5·252336	6·127726	7·003115	7.878505
		CdS	2·0511826	1·125078	2·250156	3·375234	4·500312	5·625389	6·750467	7·875545	9·000623	10·125701
		$CdSO_4$	2·2104577	1·623520	3·247040	4·870561	6·494081	8·117601	9·741121	11·364642	12·988162	14·611682
		$Cd(NO_3)_2$	2·2652294	1·841745	3·683489	5·525234	7·366978	9·208723	11·050467	12·892212	14·733956	16·575701
	CdS	Cd	1·8910187	0·778070	1·556140	2·334210	3·112280	3·890350	4·668420	5·446490	6·224560	7·002630
		CdO	1·9438174	0·888827	1·777655	2·666482	3·555309	4·444137	5·332964	6·221792	7·110619	7·999446
	$CdSO_4$	Cd	1·7317436	0·539192	1·078384	1·617577	2·156769	2·695961	3·235153	3·774345	4·313537	4·852730
		CdO	1·7895423	0·615946	1·231891	1·847837	2·463782	3·079728	3·695673	4·311619	4·927564	5·543510
Cæsium	CsCl	Cs	1·8973806	0·789552	1·579104	2·368655	3·158207	3·947759	4·737311	5·526863	6·316414	7·105966
	Cs_2SO_4	Cs	1·8661011	0·734685	1·469370	2·204055	2·938739	3·672434	4·408109	5·142794	5·877479	6·612164
		CsCl	1·9687205	0·930509	1·861017	2·791526	3·722035	4·652544	5·583053	6·513561	7·444070	8·374579
	Cl_2	Cs	2·5742354	3·751763	7·503526	11·255289	15·007052	18·758815	22·510578	26·262341	30·014104	33·765867
		CsCl	2·6768548	4·751763	9·503526	14·255289	19·007052	23·758815	28·510578	33·262341	38·014104	42·765867
	SO_4	Cs	2·4423390	2·769103	5·538205	8·307308	11·076411	13·845513	16·614616	19·383718	22·152821	24·921924
		CsCl	2·5449584	3·507183	7·014366	10·521549	14·028732	17·535915	21·043098	24·550281	28·057464	31·564647
		Cs_2SO_4	2·5762379	3·769103	7·538205	11·307308	15·076411	18·845513	22·614616	26·383718	30·152821	33·921924
	AgCl	Cs	1·9673630	0·927605	1·855210	2·782815	3·710420	4·638025	5·565630	6·493235	7·420840	8·348445
		CsCl	2·0699824	1·174850	2·349700	3·524550	4·699400	5·874250	7·049100	8·223950	9·398800	10·573650
Calcium	CaO	Ca	1·8541815	0·714795	1·429590	2·144385	2·859180	3·573975	4·288770	5·003565	5·718360	6·433155
		$CaCO_3$	2·2514712	1·784314	3·568627	5·352941	7·137255	8·921569	10·705882	12·490196	14·274510	16·058823
		$CaSO_4$	2·3850866	2·427094	4·854189	7·281283	9·708378	12·135472	14·562567	16·989661	19·416756	21·843850
		$Ca_3P_2O_8$	2·2656977	1·843731	3·687463	5·531194	7·374926	9·218657	11·062389	12·906120	14·749851	16·593583
	$CaCO_3$	Ca	1·6027103	0·400599	0·801199	1·201798	1·602398	2·002997	2·403596	2·804196	3·204795	3·605395
		CaO	1·7485288	0·560440	1·120879	1·681319	2·241758	2·802198	3·362637	3·923077	4·483516	5·043956
		$CaSO_4$	2·1346154	1·360240	2·720480	4·080719	5·440959	6·801199	8·161439	9·521678	10·881918	12·242158
		$Ca_3P_2O_8$	2·0142265	1·033300	2·066600	3·099900	4·133200	5·166500	6·199800	7·233100	8·266400	9·299700
	$CaSO_4$	Ca	1·4690949	0·294506	0·589013	0·883519	1·178026	1·472532	1·767039	2·061545	2·356052	2·650558
		CaO	1·6149134	0·412015	0·824031	1·236046	1·648061	2·060076	2·472092	2·884107	3·296122	3·708137
		$CaCO_3$	1·8663846	0·735165	1·470329	2·205494	2·940658	3·675823	4·410987	5·146152	5·881316	6·616481
		$Ca_3P_2O_8$	1·8806110	0·759646	1·519291	2·278937	3·038582	3·798228	4·557873	5·317519	6·077164	6·836810
	$Ca_3P_2O_8$	Ca	1·5884838	0·387689	0·775379	1·163068	1·550757	1·938447	2·326136	2·713825	3·101515	3·489204

		CaO	1·7343023	0·542378	1·084756	1·627135	2·169513	2·711892	3·254270	3·796648	4·339027	4·881405
		$CaCO_3$	1·9857735	0·967773	1·935546	2·903319	3·871092	4·838866	5·806639	6·774412	7·742185	8·709958
		$CaSO_4$	2·1193890	1·316403	2·632807	3·949210	5·265614	6·582017	7·898421	9·214824	10·531228	11·847631
Carbon	CO_2	C	1·4357285	0·272727	0·545455	0·818182	1·090909	1·363636	1·636364	1·909091	2·181818	2·454545
	$CaCO_3$	C	1·0787471	0·119880	0·239760	0·359640	0·479520	0·599401	0·719281	0·839161	0·959041	1·078921
		CO_2	1·6430186	0·439560	0·879121	1·318681	1·758242	2·197802	2·637363	3·076923	3·516484	3·956044
	$BaCO_3$	C	0·7838341	0·060790	0·121581	0·182371	0·243161	0·303951	0·364742	0·425532	0·486322	0·547112
		CO_2	1·3481056	0·232898	0·445795	0·668693	0·891591	1·114488	1·337386	1·560284	1·783181	2·006079
Cerium	CeO_2	Ce	1·9105996	0·813953	1·627907	2·441860	3·255814	4·069767	4·883721	5·697674	6·511628	7·325581
		Ce_2O_3	1·9793154	0·953488	1·906977	2·860465	3·813953	4·767442	5·720930	6·674419	7·627907	8·581395
		$Ce_2(SO_4)_3$	2·2179275	1·651686	3·303372	4·955058	6·606744	8·258430	9·910116	11·561802	13·213488	14·865174
		$Ce_2(SO_4)_3 + 5H_2O$	2·2818391	1·913547	3·827093	5·740640	7·654186	9·567733	11·481279	13·394826	15·308372	17·221919
Chlorine	$AgCl$	Cl	1·3931276	0·247245	0·494490	0·741735	0·988980	1·236225	1·483470	1·730716	1·977961	2·225206
		HCl	1·4053042	0·254275	0·508551	0·762826	1·017101	1·271377	1·525652	1·779927	2·034203	2·288478
		Cl_2O	1·4815012	0·303041	0·606082	0·909123	1·212163	1·515204	1·818245	2·121286	2·424327	2·727368
		$HClO$	1·5633233	0·365867	0·731734	1·097601	1·463468	1·829335	2·195202	2·561068	2·926935	3·292802
		Cl_2O_3	1·6176633	0·414632	0·829265	1·243897	1·658530	2·073162	2·487795	2·902427	3·317060	3·731692
		$HClO_2$	1·6789356	0·477458	0·954917	1·432376	1·909834	2·387292	2·864751	3·342209	3·819668	4·297126
		Cl_2O_5	1·7211706	0·526224	1·052448	1·578672	2·104896	2·631120	3·157344	3·683568	4·209792	4·736016
		$HClO_3$	1·7701548	0·589050	1·178100	1·767150	2·356200	2·945250	3·534300	4·123350	4·712401	5·301451
		Cl_2O_7	1·8046951	0·637816	1·275631	1·913447	2·551262	3·189078	3·826894	4·464709	5·102525	5·740340
		$HClO_4$	1·8454960	0·700642	1·401283	2·101925	2·802567	3·503208	4·203850	4·904492	5·605133	6·305775
Chromium	Cr_2O_3	Cr	1·8354530	0·684625	1·369251	2·053876	2·738502	3·423127	4·107753	4·792378	5·477004	6·161629
		CrO_3	2·1190494	1·315374	2·630749	3·946123	5·261498	6·576872	7·892247	9·207621	10·522996	11·838370
		Cr_2Cl_6	2·3185075	2·082129	4·164258	6·246386	8·328515	10·410644	12·492773	14·574901	16·657030	18·739159
		$Cr_2(SO_4)_3$	2·4112922	2·578055	5·156110	7·734166	10·312221	12·890276	15·468331	18·046386	20·624442	23·202497
		K_2CrO_4	2·4073116	2·554534	5·109067	7·663601	10·218134	12·772668	15·327201	17·881735	20·436268	22·990802
		$K_2Cr_2O_7$	2·2866706	1·934954	3·869908	5·804862	7·739816	9·674770	11·609724	13·544678	15·479632	17·414586
		$K_2Cr_2(SO_4)_4+24H_2O$	2·8172047	6·564547	13·129093	19·693640	26·258187	32·822733	39·387280	45·951827	52·516373	59·080920
		CrO_2Cl_2	2·3089470	2·036794	4·073587	6·110381	8·147175	10·183968	12·220762	14·257556	16·294350	18·331143
		$K_2Cr_2O_6Cl_2$	2·3609082	2·295664	4·591327	6·886991	9·182654	11·478318	13·773982	16·069645	18·365309	20·660972
	$BaCrO_4$	Cr	1·3128597	0·205523	0·411045	0·616568	0·822091	1·027613	1·233136	1·438659	1·644181	1·849704
		Cr_2O_3	1·4774067	0·300197	0·600394	0·900592	1·200789	1·500986	1·801183	2·101381	2·401578	2·701775
		CrO_3	1·5964561	0·394872	0·789744	1·184615	1·579487	1·974359	2·369231	2·764103	3·158974	3·553846
		Cr_2Cl_6	1·7959142	0·625049	1·250099	1·875148	2·500197	3·125246	3·750296	4·375345	5·000394	5·625444
		$K_2Cr_2O_7$	1·7640773	0·580868	1·161736	1·742604	2·323471	2·904339	3·485207	4·066075	4·646943	5·227811
	$PbCrO_4$	Cr	1·2076352	0·161300	0·322601	0·483901	0·645201	0·806502	0·967802	1·129102	1·290402	1·451703
		Cr_2O_3	1·3721822	0·235604	0·471207	0·706811	0·942415	1·178019	1·413622	1·649226	1·884830	2·120433
		CrO_3	1·4912316	0·309907	0·619814	0·929721	1·239628	1·549536	1·859443	2·169350	2·479257	2·789164
		Cr_2Cl_6	1·6906897	0·490557	0·981115	1·471672	1·962229	2·452786	2·943345	3·433902	3·924458	4·415015

TABLE LXXVA.—*continued.*

Element.	Found.	Sought.	Logarithm of (Factor × 100).	Factor multiplied by 1	2	3	4	5	6	7	8	9
		$K_2Cr_2O_7$	1·6588528	0·455882	0·911765	1·367647	1·823529	2·279412	2·735294	3·191176	3·647059	4·102941
	$K_2Cr_2O_7$	Cr	1·5487824	0·353820	0·707640	1·061460	1·415280	1·769100	2·122920	2·476740	2·830560	3·184380
		Cr_2O_3	1·7133294	0·516808	1·033616	1·550424	2·067233	2·584041	3·100849	3·617657	4·134465	4·651273
		CrO_3	1·8323788	0·679796	1·359593	2·039389	2·719185	3·398981	4·078778	4·758574	5·438370	6·118166
	CO_2	Cr	1·5962638	0·394697	0·789394	1·184091	1·578788	1·973485	2·368182	2·762879	3·157576	3·552273
		CrO_3	1·8798602	0·758333	1 516667	2·275000	3·033333	3·791667	4·550000	5·308333	6·066667	6·825000
		K_2CrO_4	2·1681224	1·472727	2·945455	4·418181	5·890909	7·363636	8·836364	10·309091	11·781818	13·254545
		$K_2Cr_2O_7$	2·0474814	1·115530	2·231061	3·346591	4·462121	5·577652	6·693182	7·808712	8·924242	10·039773
Cobalt	Co	CoO	2·1042093	1·271186	2·542373	3·813559	5·084746	6·355932	7·627119	8·898305	10·169492	11·440678
		Co_3O_4	2·1340437	1·361582	2·723164	4·084746	5·446328	6·807910	8·169492	9·531073	10·892655	12·254237
		Co_2O_3	2·1482261	1·406780	2·813559	4·220339	5·627119	7·033898	8·440678	9·847458	11·254237	12·661017
		$CoCl_2$	2·3427572	2·201695	4·403390	6·605085	8·806780	11·008475	13·210170	15·411864	17·613559	19·815254
		$CoCl_2 + 6H_2O$	2·6057177	4·033831	8·067661	12·101492	16·135322	20·169153	24·202983	28·236814	32·270644	36·304475
		$CoSO_4$	2·4196178	2·628136	5·256271	7·884407	10·512542	13·140678	15·768814	18·396949	21·025085	23·653220
		$CoSO_4 + 7H_2O$	2·6781201	4·765627	9·531254	14·296881	19·062508	23·828136	28·593763	33·359390	38·125017	42·890644
		$Co(NO_3)_2 + 6H_2O$	2·6933036	4·935186	9·870373	14·805559	19·740746	24·675932	29·611119	34·546305	39·481492	44·416678
	CoO	Co	1·8957907	0·786667	1·573333	2·360000	3·146667	3·933333	4·720000	5·506667	6·293333	7·080000
		$CoCl_2$	2·2385479	1·732	3·464	5·196	6·928	8·660	10·392	12·124	13·856	15·588
		$CoSO_4$	2·3154385	2·067467	4·134933	6·202400	8·269867	10·337333	12·404800	14·472267	16·539733	18·607200
	Co_3O_4	Co	1·8659563	0·734440	1·468880	2·203319	2·937759	3·672199	4·406639	5·141079	5·875519	6·609958
		CoO	1·9701656	0·933610	1·867220	2·800830	3·734440	4·668050	5·601660	6·535270	7·468880	8·402490
		$CoCl_2$	2·2087135	1·617012	3·234025	4·851037	6·468050	8·085062	9·702075	11·319087	12·936100	14·553112
		$CoSO_4$	2·2856041	1·930207	3·860415	5·790622	7·720830	9·651037	11·581245	13·511452	15·441660	17·371867
	$CoSO_4$	Co	1·5803522	0·380498	0·760996	1·141494	1·521991	1·902489	2·282987	2·663485	3·043983	3·424481
		CoO	1·6845615	0·483684	0·967367	1·451051	1·934735	2·418419	2·902102	3·385786	3·869470	4·353154
	$K_3Co(NO_2)_6$	Co	1·1150511	0·130332	0·260664	0·390996	0·521328	0·651660	0·781992	0·912324	1·042656	1·172988
		CoO	1·2192604	0·165676	0·331353	0·497029	0·662705	0·828381	0·994058	1·159734	1·325410	1·491087
Copper	Cu	Cu_2O	2·0514559	1·125786	2·251572	3·377358	4·503145	5·628931	6·754717	7·880503	9·006289	10·132075
		CuO	2·0974560	1·251572	2·503145	3·754717	5·006289	6·257862	7·509434	8·761006	10·012579	11·264151
		Cu_2S	2·0976196	1·252044	2·504088	3·756132	5·008176	6·260220	7·512264	8·764308	10·016352	11·268396
		CuS	2·1772730	1·504088	3·008176	4·512264	6·016352	7·520440	9·024528	10·528616	12·032704	13·536792
		Cu_2Cl_2	2·1923974	1·557390	3·114780	4·672170	6·229560	7·786950	9·344340	10·901730	12·459119	14·016509
		$CuCl_2 + 2H_2O$	2·3271403	2·123931	4·247862	6·371792	8·495723	10·619654	12·743585	14·867516	16·991447	19·115377
		$CuSO_4$	2·3997390	2·510377	5·020755	7·531132	10·041509	12·551887	15·062264	17·572641	20·083019	22·593396

		$CuSO_4+5H_2O$	2·5940310	3·926730	7·853459	11·780189	15·706918	19·633648	23·560377	27·487107	31·413836	35·340566
	Cu_2O	Cu	1·9485441	0·888268	1·776536	2·664804	3·553073	4·441341	5·329609	6·217877	7·106145	7·994418
		CuO	2·0460001	1·111732	2·223464	3·335196	4·446927	5·558659	6·670391	7·782123	8·893855	10·005587
		Cu_2S	2·0461637	1·112151	2·224302	3·336452	4·448603	5·560754	6·672905	7·785056	8·897207	10·009357
		CuS	2·1258174	1·336034	2·672067	4·008101	5·344134	6·680168	8·016201	9·352235	10·688268	12·024302
	CuO	Cu	1·9025440	0·798995	1·597890	2·396985	3·195980	3·994975	4·793970	5·592965	6·391960	7·190955
		Cu_2O	1·9539999	0·899497	1·798995	2·698492	3·597990	4·497487	5·396985	6·296482	7·195980	8·095477
		Cu_2S	2·0001636	1·000377	2·000754	3·001131	4·001508	5·001884	6·002261	7·002638	8·003015	9·003392
		CuS	2·0798173	1·201759	2·403518	3·605276	4·807035	6·008794	7·210553	8·412312	9·614070	10·815829
	Cu_2S	Cu	1·9023804	0·798694	1·597388	2·396082	3·194776	3·993470	4·792164	5·590858	6·389552	7·188246
		CuO	1·9998364	0·999623	1·999246	2·998870	3·998493	4·998116	5·997739	6·997363	7·996986	8·996609
	CuS	Cu	1·8227267	0·664855	1·329709	1·994564	2·659419	3·324273	3·989128	4·653983	5·318838	5·983692
		CuO	1·9201827	0·832114	1·664227	2·496341	3·328455	4·160569	4·992682	5·824796	6·656910	7·489024
	$Cu_2(CNS)_2$	Cu	1·7181665	0·522597	1·045193	1·567790	2·090386	2·612983	3·135579	3·658176	4·180772	4·703369
		CuO	1·8156225	0·654067	1·308135	1·962202	2·616270	3·270337	3·924404	4·578472	5·232539	5·886606
Decipium	Existence	uncertain.										
Erbium	Er_2O_3	Er	1·9413545	0·873684	1·747368	2·621053	3·494737	4·368421	5·242105	6·115789	6·989474	7·863158
		$Er_2(SO_4)_3$	2·2127342	1·632053	3·264105	4·896158	6·528211	8·160263	9·792316	11·424368	13·056421	14·688474
		$Er_2(SO_4)_3+7H_2O$	2·2931252	1·963926	3·927853	5·891779	7·855705	9·819632	11·783558	13·747484	15·711411	17·675337
Fluorine	CaF_2	F_2	1·6871315	0·486556	0·973111	1·459667	1·946223	2·432778	2·919334	3·405890	3·892446	4·379001
		HF	1·7095827	0·512369	1·024737	1·537106	2·049475	2·561844	3·074212	3·586581	4·098950	4·611319
		H_2SiF_6	1·7898430	0·616372	1·232744	1·849117	2·465489	3·081861	3·698233	4·314605	4·930977	5·547350
	H_2SiF_6	F_2	1·8972895	0·789386	1·578772	2·368159	3·157545	3·946931	4·736317	5·525703	6·315090	7·104476
		HF	1·9197397	0·831265	1·662530	2·493796	3·325061	4·156326	4·987591	5·818857	6·650122	7·481387
		CaF_2	2·2101570	1·622396	3·244793	4·867189	6·489586	8·111982	9·734378	11·356775	12·979171	14·601568
		SiF_4	2·0351765	1·084367	2·168735	3·253102	4·337470	5·421837	6·506204	7·590572	8·674939	9·759306
	K_2SiF_6	F_2	1·7131025	0·516538	1·033077	1·549615	2·066153	2·582691	3·099230	3·615768	4·132306	4·648845
		HF	1·7355527	0·543920	1·087840	1·631760	2·175680	2·719600	3·263520	3·807440	4·351360	4·895280
		CaF_2	2·0259700	1·061622	2·123244	3·184866	4·246488	5·308111	6·369733	7·431348	8·492977	9·554599
		SiF_4	1·8509895	0·709560	1·419121	2·128681	2·838242	3·547802	4·257363	4·966923	5·676484	6·386044
	$BaSiF_6$	F_2	1·6100571	0·407434	0·814868	1·222302	1·629736	2·037169	2·444603	2·852037	3·259471	3·666905
		HF	1·6325073	0·429049	0·858099	1·287148	1·716197	2·145247	2·574296	3·003345	3·432395	3·861444
		CaF_2	1·9229246	0·837384	1·674768	2·512152	3·349535	4·186919	5·024303	5·861687	6·699071	7·536455
		SiF_4	1·7479441	0·559685	1·119371	1·679056	2·238742	2·798427	3·358113	3·917798	4·477484	5·037169
	SiO_2	F_2	2·5768979	3·774834	7·549669	11·324503	15·099338	18·874172	22·649007	26·423841	30·198675	33·973510
		HF	2·5993481	3·975099	7·950199	11·925298	15·900397	19·875497	23·850596	27·825695	31·800795	35·775894
		CaF_2	2·8897654	7·758278	15·516556	23·274834	31·033113	38·791391	46·549669	54·307947	62·066225	69·824503
		SiF_4	2·7147849	5·185430	10·370861	15·556291	20·741722	25·927152	31·112583	36·298013	41·483444	46·668874
Gallium	Ga_2O_3	Ga	1·8719702	0·744681	1·489362	2·234043	2·978723	3·723404	4·468085	5·212766	5·957447	6·702128
		$GaCl_2$	2·1757832	1·498936	2·997872	4·496809	5·995745	7·494681	8·993617	10·492553	11·991489	13·490426
		Ga_2Cl_6	2·2732477	1·876064	3·752128	5·628192	7·504255	9·380319	11·256383	13·132447	15·008511	16·884575

TABLE LXXVA.—*continued.*

Element.	Found.	Sought.	Logarithm of (Factor × 100).	Factor multiplied by 1	2	3	4	5	6	7	8	9
		$Ga_2(NO_3)_6$	2·4353157	2·724681	5·449362	8·174043	10·898723	13·623404	16·348085	19·072766	21·797447	24·522128
		$Ga_2(SO_4)_3$	2·3574686	2·277553	4·555106	6·832660	9·110213	11·387766	13·665319	15·942872	18·220426	20·497979
		$(NH_4)_2Ga_2(SO_4)_4+24H_2O$	2·7226899	5·280681	10·561362	15·842043	21·122723	26·403404	31·684085	36·964766	42·245447	47·526128
Germanium	GeO_2	Ge	1·8412217	0·693780	1·387560	2·081340	2·775120	3·468899	4·162679	4·856459	5·550239	6·244019
		$GeCl_4$	2·3119059	2·050718	4·101435	6·152153	8·202871	10·253588	12·304306	14·355024	16·405742	18·456459
		$GeBr_4$	2·5745463	3·754450	7·508900	11·263349	15·017799	18·772249	22·526699	26·281148	30·035598	33·790048
		GeI_4	2·7442368	5·549283	11·098566	16·647850	22·197133	27·746416	33·295699	38·844983	44·394266	50·043549
		GeS_2	2·1163980	1·307368	2·614737	3·922105	5·229474	6·536842	7·844211	9·151579	10·458947	11·766316
Gold	Au	$AuCl_3$	2·1873233	1·539300	3·078600	4·617901	6·157201	7·696501	9·235801	10·775101	12·314402	13·853702
		Au_2O_3	2·0498782	1·121704	2·243408	3·365112	4·486815	5·608519	6·730223	7·851927	8·973631	10·095335
		Au_2S	2·0339414	1·081288	2·162576	3·243864	4·325152	5·406440	6·487728	7·569016	8·650304	9·731592
		Au_2S_2	2·0654214	1·162576	2·325152	3·487728	4·650304	5·812880	6·975456	8·138032	9·300608	10·463185
Hydrogen	H_2O	H_2	1·0488321	0·111901	0·223801	0·335702	0·447602	0·559503	0·671403	0·783304	0·895204	1·007105
Indium	In_2O_3	In	1·9170257	0·826087	1·652174	2·478261	3·304348	4·130435	4·956522	5·782609	6·608696	7·434783
		$InCl_3$	2·2032340	1·596739	3·193578	4·790217	6·386957	7·983696	9·580435	11·177174	12·773913	14·370652
		$In_2(SO_4)_3$	2·2718921	1·870217	3·740435	5·610652	7·480870	9·351087	11·221304	13·091522	14·961739	16·831957
		$(NH_4)_2In_2(SO_4)_4+24H_2O$	2·5928234	3·915826	7·831652	11·747478	15·663304	19·579130	23·494956	27·410783	31·326609	35·242435
Iodine	AgI	I	1·7326294	0·540293	1·080586	1·620879	2·161172	2·701465	3·241758	3·782051	4·322344	4·862637
		HI	1·7360668	0·544586	1·089173	1·633759	2·178346	2·722932	3·267519	3·812105	4·356691	4·901278
		I_2O_5	1·8516651	0·710665	1·421331	2·131996	2·842661	3·553326	4·263992	4·974657	5·685322	6·395988
		I_2O_7	1·8914339	0·778814	1·557628	2·336443	3·115257	3·894071	4·672885	5·451699	6·230514	7·009328
	PbI_2	I	1·7409966	0·550803	1·101607	1·652410	2·203213	2·754016	3·304820	3·855623	4·406426	4·957230
		HI	1·7444340	0·555180	1·110360	1·665541	2·220721	2·775901	3·331081	3·886261	4·441442	4·996622
		I_2O_5	1·8600323	0·724490	1·448980	2·173469	2·897959	3·622449	4·346939	5·071429	5·795918	6·520408
		I_2O_7	1·8998011	0·793964	1·587929	2·381893	3·175858	3·969822	4·763786	5·557751	6·351715	7·145680
	PdI_2	I	1·8477768	0·704331	1·408662	2·112993	2·817324	3·521655	4·225986	4·930316	5·634647	6·338978
		HI	1·8512142	0·709928	1·419856	2·129783	2·839711	3·549639	4·259567	4·969495	5·679422	6·389350
		I_2O_5	1·9668125	0·926430	1·852860	2·779289	3·705719	4·632159	5·558579	6·485008	7·411438	8·337868
		I_2O_7	2·0065813	1·015269	2·030539	3·045808	4·061077	5·076346	6·081616	7·106885	8·122154	9·137424
	KI	I	1·8831824	0·764157	1·528313	2·292470	3·056626	3·820783	4·584940	5·349096	6·113253	6·877410
		HI	1·8866198	0·770229	1·540458	2·310687	3·080916	3·851145	4·621373	5·391602	6·161831	6·932060

		I_2O_5	2·0022181	1·005120	2·010241	3·015361	4·020482	5 025602	6·030723	7·035843	8·040964	9·046084
		I_2O_7	2·0419869	1·101506	2·203012	3·304518	4·406024	5·507530	6·609036	7·710542	8·812048	9·913554
Iridium	Ir	$IrCl_4$	2·2392281	1·734715	3·469430	5·204145	6·938860	8·673575	10·408290	12·143005	13·877720	15·612435
	$(NH_4)_2IrCl_6$	Ir	1·6402883	0·436806	0·873611	1·310417	1·747223	2·184029	2·620834	3·057640	3·494446	3·931252
		$IrCl_4$	1·8795164	0·757733	1·515467	2·273200	3·030934	3·788667	4·546401	5·304134	6·061868	6·819601
	K_2IrCl_6	Ir	1·6007119	0·398760	0·797521	1·196281	1·595041	1·993802	2·392562	2·791322	3·190083	3·588843
		$IrCl_4$	1·8399400	0·691736	1·383471	2 075207	2·766942	3·458678	4·150413	4·842149	5·533884	6·225620
Iron	Fe_2O_3	Fe	1·8448651	0·699625	1·399249	2·098874	2·798498	3·498123	4 197747	4·897372	5·596996	6·296621
		Fe_2O_2	1·9541821	0·899875	1·799750	2·699625	3·599499	4·499374	5·399249	6·299124	7·198999	8·098874
		Fe_3O_4	1·9852580	0·966625	1·933250	2·899875	3·866500	4·833125	5·799750	6·766375	7·733000	8·699624
		FeS	2·0417384	1·100876	2·201752	3·302628	4·403504	5·504380	6·605257	7·706133	8·807009	9·907885
	Fe_3O_4	Fe	1·8596071	0·723781	1·447561	2·171342	2·895123	3·618904	4·342684	5·066465	5·790246	6·514027
		Fe_2O_2	1·9689241	0·930945	1·861890	2·792836	3·723781	4·654726	5·585671	6·516616	7·447561	8·378507
		Fe_2O_3	2·0147420	1·035274	2·070548	3·105822	4·141096	5·176370	6·211644	7·246918	8·282192	9·317467
		FeS	2·0564805	1·138886	2·277773	3·416659	4·555546	5·694432	6·833319	7·972205	9·111092	10·249978
	FeS	Fe	1·8031266	0·635516	1·271032	1·906548	2·542065	3·177581	3·813097	4·448613	5·084129	5·719645
		Fe_2O_2	1·9124436	0·817417	1·634834	2·452251	3·269668	4·087085	4·904502	5·721919	6·539336	7·356753
		Fe_3O_4	1·9435195	0·878051	1·756101	2·634152	3·512203	4·390253	5·268304	6·146354	7·024405	7·902456
		Fe_2O_3	1·9582615	0·908367	1·816735	2·725103	3·633470	4·451837	5·450205	6·358572	7·266940	8·175307
	$Fe_3P_2O_8$	Fe	1·6710142	0·468829	0·937657	1·406486	1·875314	2·344143	2·812972	3·281800	3·750629	4·219458
		Fe_2O_2	1·7803312	0·603019	1·206039	1·809058	2·412077	3·015096	3·618116	4·221135	4·824154	5·427174
		Fe_3O_4	1·8114071	0·647750	1·295499	1·943249	2·590998	3·238748	3·886497	4·534247	5·181996	5·829746
		Fe_2O_3	1·8261491	0·670115	1·340229	2·010344	2·680458	3·350573	4·020688	4·690802	5·360917	6·031032
		FeS	1·8678876	0·737713	1·475426	2·213140	2·950853	3·688566	4·426279	5·163992	5·901705	6·639419
Lanthanum	La_2O_3	La	1·9307811	0·852670	1·705341	2·558011	3·410681	4·263352	5·116022	5·968692	6·821362	7·674033
		La_2Cl_6	2·1776879	1·505525	3·011050	4·516575	6·022099	7·527624	9·033149	10·538674	12·044199	13·549724
		$La_2(SO_4)_3$	2·2398560	1·737201	3·474401	5·211602	6·948803	8·686004	10·423204	12·160405	13·897606	15·634807
		$La_2(SO_4)_3+9H_2O$	2·3492483	2·234880	4·469761	6·704641	8·939521	11·174401	13·409282	15·644162	17·879042	20·113923
Lead	Pb	PbO	2·0323496	1·077332	2·154664	3·231996	4·309328	5·386660	6·463992	7·541324	8·618656	9·695988
		PbS	2·0625647	1·154954	2·309908	3·464862	4·619816	5·774770	6·929724	8·084676	9·239633	10·394587
		$PbCl_2$	2·1279717	1·342678	2·685355	4·028033	5·370710	6·713388	8·056066	9·398743	10·741421	12·084099
		PbI_2	2·3475634	2·226196	4·452392	6·678589	8·904785	11·130981	13·357177	15·583374	17·809570	20·035766
		$PbSO_4$	2·1656248	1·464282	2·928565	4·392847	5·857129	7·321411	8·785694	10·249976	11·714258	13·178540
	PbO	Pb	1·9676504	0·928219	1·856438	2·784657	3·712876	4·641095	5·569314	6·497533	7·425751	8·353970
		PbS	2·0302151	1·072050	2·144100	3·216151	4·288201	5·360251	6·432301	7·504352	8·576402	9·648452
		$PbSO_4$	2·1332752	1·359175	2·718349	4·077524	5·436698	6·795873	8·155047	9·514222	10·873396	12·232571
	$PbCl_2$	Pb	1·8720283	0·744780	1·489561	2·234341	2·979122	3·723902	4·468682	5·213463	5·958243	6·703024
		PbO	1·9043779	0·802376	1·604752	2·407127	3·209503	4·011879	4·814255	5·616631	6·419006	7·221382
		PbS	1·9345930	0·860187	1·720374	2·580562	3·440749	4·300936	5·161123	6·021310	6·881497	7·741685
	PbI_2	Pb	1·6524366	0·449197	0·898393	1·347590	1·796787	2·245983	2·695180	3·144377	3·593574	4·042770
		PbO	1·6847862	0·483934	0·967868	1·451802	1·935736	2·419670	2·903604	3·387538	3·871472	4·355406
		PbS	1·7150013	0·518802	1·037603	1·556405	2·075206	2·594008	3·112809	3·631611	4·150412	4·669214

TABLE LXXVA.—*continued.*

Element.	Found.	Sought.	Logarithm of (Factor × 100).	Factor multiplied by 1	2	3	4	5	6	7	8	9
	PbS	Pb	1·9374353	0·865835	1·731671	2·597506	3·463341	4·329176	5·195012	6·060847	6·926682	7·792518
		PbO	1·9697849	0·932792	1·865584	2·798376	3·731168	4·663960	5·596753	6·529545	7·462337	8·395129
	$PbSO_4$	Pb	1·8343752	0·682928	1·365857	2·048785	2·731714	3·414642	4·097571	4·780499	5·463128	6·146356
		PbO	1·8667248	0·735741	1·471481	2·207222	2·942963	3·678703	4·414444	5·150185	5·885926	6·621666
		PbS	1·8969399	0·788751	1·577502	2·366253	3·155004	3·943775	4·732506	5·521257	6·310008	7·098759
	$PbCrO_4$	Pb	1·8065580	0·640557	1·281115	1·921672	2·562229	3·202786	3·843344	4·483901	5·124458	5·765015
		PbO	1·8389076	0·690093	1·380186	2·070279	2·760372	3·450464	4·140557	4·830650	5·520743	6·210836
		PbS	1·8691227	0·739814	1·479628	2·219443	2·959257	3·699071	4·438885	5·178700	5·918514	6·658328
	$Pb_3P_2O_8$	Pb	1·8840215	0·765635	1·531269	2·296904	3·062538	3·828173	4·593808	5·359442	6·125077	6·890711
		PbO	1·9163711	0·824843	1·649685	2·474528	3·209371	4·124214	4·949056	5·773899	6·598742	7·423585
		PbS	1·9465863	0·884273	1·768546	2·652819	3·537091	4·421364	5·305637	6·189910	7·074183	7·958456
Lithium	LiCl	Li	1·2251080	0·167922	0·335844	0·503766	0·671689	0·839611	1·007533	1·175455	1·343377	1·511299
	Li_2SO_4	Li	1·1061191	0·127679	0·255358	0·383037	0·510716	0·638394	0·766073	0·893752	1·021431	1·149110
		LiCl	1·8873483	0·771522	1·543044	2·314566	3·086088	3·857610	4·629132	5·400654	6·172176	6·943698
	Li_2CO_3	Li	1·2847388	0·192637	0·385273	0·577910	0·770546	0·963183	1·155820	1·348456	1·541093	1·733729
		LiCl	2·0596308	1·147178	2·294356	3·441534	4·588712	5·735890	6·883068	8·030246	9·177424	10·324602
	Li_3PO_4	Li	1·2656190	0·184340	0·368679	0·553019	0·737359	0·921699	1·106038	1·290378	1·474718	1·659058
		LiCl	2·0405110	1·097769	2·195538	3·293307	4·391076	5·488845	6·586614	7·684383	8·782152	9·879921
Magnesium	MgO	Mg	1·7807261	0·603568	1·207136	1·810704	2·414272	3·017839	3·621407	4·224975	4·828543	5·432111
		$MgCO_3$	2·3201854	2·090188	4·180377	6·270565	8·360753	10·450912	12·541130	14·631318	16·721507	18·811695
		$MgSO_4$	2·4747474	2·983647	5·967294	8·950942	11·934589	14·918236	17·901883	20·885530	23·869177	26·852825
		$MgSO_4+7H_2O$	2·7859221	6·108325	12·216650	18·324975	24·433300	30·541625	36·649950	42·728275	48·866601	54·974926
	$MgSO_4$	Mg	1·3059787	0·202292	0·404584	0·606876	0·809168	1·011460	1·213752	1·416044	1·618336	1·820628
		MgO	1·5252526	0·335160	0·670321	1·005481	1·340641	1·675801	2·010962	2·346122	2·681282	3·016442
		$MgCO_3$	1·8454380	0·700548	1·401096	2·101644	2·802192	3·502740	4·203288	4·903837	5·604385	6·304933
		$MgSO_4+7H_2O$	2·3111747	2·047268	4·094536	6·141804	8·189072	10·236339	12·283607	14·330875	16·378143	18·425411
	$Mg_2P_2O_7$	Mg	1·3399481	0·21875	0·43750	0·65625	0·87500	1·09375	1·31250	1·53125	1·75000	1·96875
		MgO	1·5592220	0·362428	0·724856	1·087284	1·449713	1·812141	2·174569	2·536997	2·899425	3·261853
		$MgCO_3$	1·8794074	0·757543	1·515086	2·272629	3·030172	3·787715	4·545259	5·302802	6·060345	6·817888
		$MgSO_4$	2·0339694	1·081358	2·162716	3·244073	4·325431	5·406789	6·488147	7·569504	8·650862	9·732220
		$MgSO_4+7H_2O$	2·3451441	2·213829	4·427658	6·641487	8·855316	11·069145	13·282974	15·496803	17·710632	19·924461
Manganese	Mn_3O_4	Mn	1·8576484	0·720524	1·441048	2·161572	2·882096	3·602620	4·323144	5·043668	5·764192	6·484716
		MnO	1·9685441	0·930131	1·860262	2·790393	3·720524	4·650655	5·580786	6·510917	7·441048	8·371179

		MnO_2	2·0568050	1·139738	2·279476	3·419214	4·558952	5·698690	6·838428	7·978166	9·117904	10·257642
		$MnSO_4$	2·2964352	1·978952	3·957903	5·936855	7·915806	9·894758	11·873709	13·852661	15·831612	17·810564
	Mn_2O_3	Mn	1·8427356	0·696203	1·392405	2·088608	2·784810	3·481013	4·177215	4·873418	5·569620	6·265823
		MnO	1·9536312	0·898734	1·797468	2·696203	3·594937	4·493671	5·392405	6·291139	7·189873	8·088608
		MnO_2	2·0418921	1·101266	2·202532	3·303797	4·405063	5·506329	6·607595	7·708861	8·810127	9·911392
		$MnSO_4$	2·2815224	1·912152	3·824304	5·736456	7·648608	9·560759	11·472911	13·385063	15·297215	17·209367
	MnS	Mn	1·8005440	0·631748	1·263496	1·895245	2·526993	3·158741	3·790489	4·422238	5·053986	5·685734
		MnO	1·9114397	0·815530	1·631059	2·446589	3·262118	4·077648	4·893177	5·708707	6·524236	7·339766
		MnO_2	1·9997006	0·999311	1·998622	2·997932	3·997243	4·996554	5·995865	6·995176	7·994487	8·993797
		$MnSO_4$	2·2393308	1·735125	3·470250	5·205376	6·940501	8·675626	10·410751	12·145876	13·881002	15·616127
	$MnSO_4$	Mn	1·5612132	0·364094	0·728187	1·092281	1·456375	1·820469	2·184562	2·548656	2·912750	3·276844
		MnO	1·6721089	0·470012	0·940024	1·410036	1·880048	2·350060	2·820071	3·290083	3·760095	4·230107
		MnO_2	1·7603698	0·575930	1·151860	1·727790	2·303720	2·879650	3·455581	4·031511	4·607441	5·183371
		MnS	1·7606692	0·576327	1·152655	1·728982	2·305309	2·881636	3·457964	4·034291	4·610618	5·186946
	$Mn_2P_2O_7$	Mn	1·5880743	0·387324	0·774648	1·161972	1·549296	1·936620	2·323944	2·711268	3·098592	3·485915
		MnO	1·6989700	0·5	1·0	1·5	2·0	2·5	3·0	3·5	4·0	4·5
		MnO_2	1·7872309	0·612676	1·225352	1·838028	2·450704	3·063380	3·676056	4·288732	4 901408	5·514085
		$MnSO_4$	2·0268611	1·063803	2·127606	3·191408	4·255211	5·319014	6·382817	7·446620	8·510423	9·574225
Mercury	Hg	Hg_2Cl_2	2·0708687	1·17725	2·35450	3·53175	4·70900	5·88625	7·06350	8·24075	9·41800	10·59525
		$HgCl_2$	2·1317790	1·3545	2·7090	4·0635	5·4180	6·7725	8·1270	9·4815	10·8360	12·1905
		$HgBr_2$	2·2551760	1·7996	3·5992	5·3988	7·1984	8·9980	10·7976	12·5972	14·3968	16·1964
		HgI_2	2·3557388	2·2685	4·5370	6·8055	9·0740	11·3425	13·6110	15·8795	18·1480	20·4165
		$Hg(CN)_2$	2·1005084	1·2604	2·5208	3·7812	5·0416	6·3020	7·5624	8·8228	10·0832	11·3436
		HgO	2·0334237	1·08	2·16	3·24	4·32	5·40	6·48	7·56	8 64	9·72
		HgS	2·0645703	1·1603	2·3206	3·4809	4·6412	5·8015	6·9618	8·1221	9 2824	10·4427
	HgO	Hg	1·9665763	0·925926	1·851852	2·777778	3·703704	4·629630	5·555556	6·481482	7·407407	8·333333
		Hg_2Cl_2	2·0374450	1·090046	2·180093	3·270139	4·360185	5·450231	6·540278	7·630324	8·720370	9·810417
		$HgCl_2$	2·0983553	1·254167	2·508333	3·762500	5·016667	6·270833	7·525000	8·779167	10·033333	11·287500
		HgS	2·0311466	1·074352	2·148704	3·223056	4·297407	5·371759	6·446111	7·520463	8·594815	9·669167
	HgS	Hg	1·9354297	0·861846	1·723692	2·585538	3·447384	4·309230	5·171076	6·032922	6·894769	7·756615
		Hg_2Cl_2	2·0062984	1·014608	2·029217	3·043825	4·058433	5·073041	6 087650	7·102258	8·116866	9·131475
		$HgCl_2$	2·0672087	1·167371	2·334741	3·502112	4·669482	5·836853	7·004223	8·171594	9·338964	10·506335
		HgO	1·9688534	0·930794	1·861588	2·792381	3·723175	4·653969	5·584763	6·515556	7·446350	8·377144
	Hg_2Cl_2	Hg	1·9291313	0·849437	1·698874	2·548312	3·397749	4·247186	5·096623	5·946061	6·795498	7·644935
		$HgCl_2$	2·0609103	1·150563	2·301125	3·451688	4·602251	5·752814	6·903376	8·053939	9·204502	10·355065
		HgO	1·9625550	0·917392	1·834784	2·752177	3·669579	4·586961	5·504353	6·421746	7·339138	8·256530
		HgS	1·9937016	0·985602	1·971204	2·956806	3·942408	4·928010	5·913612	6·899214	7·884816	8·870418
Molybdenum	Mo	MoO_3	2·1760913	1·5	3·0	4·5	6·0	7·5	9·0	10·5	12·0	13·5
		MoS_3	2·3014370	2·001875	4·003750	6·005625	8·007500	10·009375	12·011250	14·013125	16·015000	18·016875
	MoO_3	Mo	1·8239087	0·666667	1·333333	2·000000	2·666667	3·333333	4·000000	4·666667	5·333333	6·000000
		MoS_3	2·1253457	1·334583	2·669167	4·003750	5·338333	6·672917	8·007500	9·342083	10·676667	12·011250

TABLE LXXVA.—*continued.*

Element.	Found.	Sought.	Logarithm of (Factor × 100).	Factor multiplied by 1	2	3	4	5	6	7	8	9
	MoS_3	Mo	1·6985630	0·499532	0·999063	1·498595	1·998127	2·497658	2·997190	3·496722	3·996254	4·495785
		MoO_3	1·8746543	0·749298	1·498595	2·247893	2·997190	3·746488	4·495785	5·245083	5·994380	6·743678
	$PbMoO_4$	Mo	1·4177235	0·261652	0·523303	0·784955	1·046607	1·308258	1·569910	1·831562	2·093213	2·354865
		MoO_3	1·5938148	0·392478	0·784955	1·177433	1·569910	1·962388	2·354865	2·747343	3·139820	3·532298
		MoS_3	1·7191605	0·523794	1·047588	1·571382	2·095176	2·618970	3·142764	3·666558	4·190352	4·714146
Nickel	Ni	NiO	2·1046825	1·272572	2·545145	3·817717	5·090290	6·362862	7·635434	8·908007	10·180579	11·453152
		NiS	2·1892564	1·546167	3·092334	4·638501	6·184668	7·730835	9·277002	10·823169	12·369336	13·915503
		$NiSO_4$	2·4210206	2·636457	5·272913	7·909370	10·545826	13·182283	15·818739	18·455196	21·091652	23·728109
		$NiSO_4+7H_2O$	2·6798704	4·784872	9·569744	14·354617	19·139489	23·924361	28·709233	33·494106	38·278978	43·063850
		$NiCl_2+6H_2O$	2·6073838	4·049336	8·098671	12·148007	16·197342	20·246678	24·296014	28·345349	32·394685	36·444020
		$Ni(NO_3)_2+6H_2O$	2·6950698	4·955298	9·910596	14·865894	19·821193	24·776491	29·731789	34·687087	39·642385	44·597683
		$Ni_3(PO_4)_2+7H_2O$	2·4463928	2·795071	5·590142	8·385213	11·180284	13·975355	16·770426	19·565497	22·360568	25·155639
	NiO	Ni	1·8953175	0·785810	1·571620	2·357430	3·143240	3·929049	4·714859	5·500669	6·286479	7·072289
		NiS	2·0845759	1·214993	2·429987	3·644980	4·859973	6·074966	7·289960	8·504953	9·719946	10·934940
		$NiSO_4$	2·3163381	2·071754	4·143507	6·215261	8·287015	10·358768	12·430522	14·502276	16·574029	18·645783
	NiS	Ni	1·8107436	0·646761	1·293521	1·940282	2·587043	3·233803	3·880564	4·527325	5·174086	5·820846
		NiO	1·9154261	0·823050	1·646100	2·469149	3·292199	4·115249	4·938299	5·761349	6·584398	7·407448
		$NiSO_4$	2·2317642	1·705156	3·410313	5·115469	6·820626	8·525782	10·230939	11·936095	13·641252	15·346408
	$NiSO_4$	Ni	1·5789794	0·379297	0·758594	1·137891	1·517188	1·896485	2·275782	2·655079	3·034376	3·413673
		NiO	1·6836619	0·482683	0·965366	1·448049	1·930731	2·413414	2·896097	3·378780	3·861463	4·344146
		NiS	1·7682358	0·586456	1·172913	1·759369	2·345826	2·932282	3·518739	4·105195	4·691652	5·278108
		$NiSO_4+7H_2O$	2·2588498	1·814888	3·629775	5·444663	7·259550	9·074438	10·889325	12·704213	14·519101	16·333988
Niobium	Nb_2O_5	Nb	1·8460230	0·701493	1·402985	2·104478	2·805970	3·507463	4·208955	4·910448	5·611940	6·313433
		NbO	1·9142879	0·820896	1·641791	2·462687	3·283582	4·104478	4·925373	5·746269	6·567164	7·388060
		NbO_2	1·9732657	0·940298	1·880597	2·820895	3·761194	4·701492	5·641791	6·582089	7·522388	8·462686
		$NbCl_5$	2·3062649	2·024254	4·048507	6·072761	8·097015	10·121269	12·145522	14·169776	16·194030	18·218283
Nitrogen	N_2	NH_3	2·0847137	1·215385	2·430769	3·646154	4·861538	6·076923	7·292308	8·507692	9·723077	10·938461
		NH_4Cl	2·5811652	3·812108	7·624217	11·436325	15·249433	19·060541	22·872650	26·684758	30·496866	34·308974
		$(NH_4)_2SO_4$	2·6728475	4·708120	9·416239	14·124359	18·832479	23·540598	28·248718	32·956838	37·664957	42·373077
		N_2O	2·1958445	1·569801	3·139601	4·709402	6·279202	7·849003	9·418803	10·988604	12·558405	14·128205
		NO	2·3303328	2·139601	4·279202	6·418803	8·558405	10·698006	12·837607	14·977208	17·116809	19·256410
		N_2O_3	2·4328734	2·709402	5·418803	8·128205	10·837607	13·547009	16·256410	18·965812	21·675214	24·384615
		NO_2	2·5157682	3·279202	6·558405	9·837607	13·116809	16·396011	19·675214	22·954416	26·233618	29·512821

		N_2O_5	2·5853482	3·849003	7·698006	11·547009	15·396011	19·245014	23·094017	26·943020	30·792023	34·641026
		HNO_2	2·5251741	3·350997	6·701994	10·052991	13·403989	16·754986	20·105983	23·456980	26·807977	30·158974
		HNO_3	2·6523040	4·490598	8·981197	13·471795	17·962393	22·452991	26·943590	31·434188	35·924786	40·415385
		$NaNO_3$	2·7825114	6·060541	12·121083	18·181624	24·242165	30·302707	36·363248	42·423789	48·481330	54·544872
		KNO_3	2·8577705	7·207265	14·414530	21·621795	28·829060	36·036325	43·243590	50·450855	57·658120	64·865385
		C_2N_2	2·2682739	1·854701	3·709402	5·564103	7·418803	9·273504	11·128205	12·982906	14·837607	16·692308
		HCN	2·2847681	1·926496	3·852991	5·779487	7·705983	9·632479	11·558974	13·485470	15·411966	17·338461
		KCN	2·6668139	4·643162	9·286325	13·929487	18·572650	23·215812	27·858974	32·502137	37·145299	41·788461
		$CO(NH_2)_2$	2·3305641	2·140741	4·281481	6·422222	8·562963	10·703704	12·844444	14·985185	17·125926	19·266667
		$C_5H_4N_4O_3$	2·4763782	2·994872	5·989744	8·984615	11·979487	14·974359	17·969231	20·964103	23·958974	26·953846
	NH_3	N_2	1·9152863	0·822785	1·645570	2·468354	3·291139	4·113924	4·936709	5·759494	6·582278	7·405063
		NH_4Cl	2·4964515	3·136545	6·273090	9·409634	12·546179	15·682724	18·819269	21·955813	25·092358	28·228903
		$(NH_4)_2SO_4$	2·5881338	3·873769	7·747539	11·621308	15·495077	19·368847	23·242616	27·116385	30·990155	34·863924
		HNO_2	2·4404604	2·757150	5·514299	8·271449	11·028598	13·785748	16·542897	19·300047	22·057196	24·814346
		HNO_3	2·5675903	3·694796	7·389592	11·084388	14·779184	18·473980	22·168776	25·863572	29·558368	33·253165
		$NaNO_3$	2·6977977	4·986521	9·973043	14·959564	19·946085	24·932607	29·919128	34·905649	39·893171	44·878692
		KNO_3	2·7730568	5·930028	11·860056	17·790084	23·720113	29·650141	35·580169	41·510197	47·440225	53·370253
		HCN	2·2000548	1·585091	3·170183	4·755274	6·340366	7·925457	9·510549	11·095640	12·680731	14·265823
		KCN	2·5821002	3·820323	7·640647	11·460970	15·281294	19·101617	22·921941	26·742264	30·562588	34·382911
		$CO(NH_2)_2$	2·2458504	1·761369	3·522738	5·284107	7·045476	8·806845	10·568214	12·329583	14·090952	15·852321
		$C_5H_4N_4O_3$	2·3916645	2·464135	4·928270	7·392405	9·856540	12·320675	14·784810	17·248945	19·713080	22·177215
	NH_4Cl	N_2	1·4188348	0·262322	0·524644	0·786966	1·049288	1·311610	1·573932	1·836254	2·098576	2·360898
		NH_3	1·5035485	0·318822	0·637644	0·956467	1·275289	1·594111	1·912933	2·231755	2·550577	2·869400
		$(NH_4)_2SO_4$	2·0916823	1·235044	2·470087	3·705131	4·940174	6·175218	7·410261	8·645305	9·880348	11·115392
		HNO_3	2·0711388	1·177983	2·355966	3·533949	4·711932	5·889914	7·067897	8·245880	9·423863	10·601846
		$NaNO_3$	2·2013452	1·589814	3·179627	4·769441	6·359254	7·949068	9·538881	11·128695	12·718508	14·308322
		KNO_3	2·2766053	1·890624	3·781249	5·671873	7·562498	9·453122	11·343746	13·234371	15·124995	17·015620
		$CO(NH_2)_2$	1·7493989	0·561563	1·123127	1·684690	2·246254	2·807817	3·369381	3·930944	4·492508	5·054071
		$C_5H_4N_4O_3$	1·8952130	0·785621	1·571242	2·356863	3·142483	3·928104	4·713725	5·499346	6·284967	7·070588
	$(NH_4)_2SO_4$	N_2	1·3271525	0·212399	0·424798	0·637197	0·849596	1·061995	1·274394	1·486793	1·699192	1·911591
		NH_3	1·4118662	0·258146	0·516293	0·774439	1·032586	1·290732	1·548879	1·807025	2·065172	2·323318
		NH_4Cl	1·9083177	0·809688	1·619376	2·429064	3·238752	4·048440	4·858128	5·667816	6·477504	7·287193
		HNO_3	1·9794565	0·953798	1·907596	2·861395	3·815193	4·768991	5·722789	6·676587	7·630385	8·584184
		$NaNO_3$	2·1096639	1·287253	2·574506	3·861759	5·149012	6·436265	7·723518	9·010771	10·298024	11·585277
		KNO_3	2·1849230	1·530816	3·061632	4·592448	6·123264	7·654080	9·184896	10·715712	12·246528	13·777344
		$CO(NH_2)_2$	1·6577166	0·454691	0·909382	1·364074	1·718765	2·273456	2·728147	3·182839	3·637530	4·092221
		$C_5H_4N_4O_3$	1·8035307	0·636108	1·272216	1·908323	2·544431	3·180539	3·816647	4·452755	5·088863	5·724970
	N_2O_5	HNO_3	2·0669558	1·166691	2·333383	3·500074	4·666765	5·833457	7·000148	8·166839	9·333531	10·500222
		$NaNO_3$	2·1971632	1·574574	3·149149	4·723723	6·298298	7·872872	9·447446	11·022021	12·596595	14·171170
		KNO_3	2·2724223	1·872502	3·745004	5·617506	7·490007	9·362509	11·235011	13·107513	14·980015	16·852517
	AgCN	C_2N_2	1·2886334	0·194372	0·388744	0·583116	0·777487	0·971859	1·166231	1·360603	1·554975	1·749347
		HCN	1·3051276	0·201896	0·403792	0·605688	0·807584	1·009480	1·211376	1·413272	1·615168	1·817064

TABLE LXXVA.—*continued.*

Element.	Found.	Sought.	Logarithm of (Factor × 100).	Factor multiplied by 1	2	3	4	5	6	7	8	9
	Ag	KCN	1·6871734	0·486601	0·973203	1·459804	1·946406	2·433007	2·919609	3·406210	3·892812	4·379413
		C_2N_2	1·3824988	0·241267	0·482535	0·723802	0·965070	1·206337	1·447605	1·688872	1·930140	2·171407
		HCN	1·3989930	0·250607	0·501214	0·751821	1·002427	1·253034	1·503641	1·754248	2·004855	2·255462
		KCN	1·7810388	0·604003	1·208005	1·812008	2·416010	3·020013	3·624016	4·228018	4·832021	5·436023
	AgCl	N_2	0·9908785	0·097922	0·195843	0·293765	0·391686	0·489608	0·587530	0·685451	0·783373	0·881294
		NH_3	1·0755922	0·119012	0·238025	0·357037	0·476050	0·595062	0·714074	0·833087	0·952099	1·071112
		NH_4Cl	1·5720437	0·373288	0·746576	1·119863	1·493151	1·866439	2·239727	2·613014	2·986302	3·359590
		HNO_3	1·6431825	0·439727	0·879453	1·319180	1·758906	2·198633	2·638360	3·078086	3·517813	3·957539
		$CO(NH_2)_2$	1·3214426	0·209625	0·419250	0·628874	0·838499	1·048124	1·257749	1·467373	1·676998	1·886623
		$C_5H_4N_4O_3$	1·4672567	0·293263	0·586525	0·879788	1·173051	1·466313	1·759576	2·052839	2·343101	2·639364
	Cl_2	N_2	1·5977509	0·396051	0·792102	1·188152	1·584203	1·980254	2·376305	2·772355	3·168406	3·564457
		NH_3	1·6824646	0·481354	0·962708	1·444062	1·925416	2·406770	2·888124	3·369478	3·850832	4·332186
		NH_4Cl	2·1789161	1·509788	3·019577	4·529365	6·039154	7·548942	9·058731	10·568519	12·078307	13·588096
		HNO_3	2·2500549	1·778505	3·557010	5·335515	7·114020	8·892525	10·671030	12·449535	14·228039	16·006544
		$CO(NH_2)_2$	1·9283150	0·847842	1·695684	2·543526	3·391368	4·239210	5·087052	5·934894	6·782736	7·630578
		$C_5H_4N_4O_3$	2·0741291	1·186121	2·372243	3·558364	4·744485	5·930606	7·116728	8·302849	9·488970	10·675092
	$(NH_4)_2PtCl_6$	N_2	0·8013625	0·063294	0·126588	0·189882	0·253176	0·316470	0·379764	0·443058	0·506352	0·569646
		NH_3	0·8860762	0·076927	0·153853	0·230780	0·307706	0·384633	0·461559	0·538486	0·615412	0·692339
		NH_4Cl	1·3825277	0·241284	0·482567	0·723851	0·965134	1·206418	1·447701	1·688985	1·920268	2·171552
		$(NH_4)_2SO_4$	1·4742100	0·297996	0·595991	0·893987	1·191983	1·489978	1·787974	2·085970	2·383966	2·681961
		HNO_3	1·4536665	0·284228	0·568456	0·852684	1·136913	1·421139	1·705367	1·989595	2·273823	2·558051
		$CO(NH_2)_2$	1·1319266	0·135496	0·270992	0·406488	0·541984	0·677480	0·812976	0·948472	1·083968	1·219464
		$C_5H_4N_4O_3$	1·2777407	0·189557	0·379115	0·568672	0·758230	0·947787	1·137344	1·326902	1·516459	1·706017
	Pt	N_2	1·1588081	0·144148	0·288296	0·432444	0·576591	0·720739	0·864887	1·009035	1·153183	1·297331
		NH_3	1·2435218	0·175195	0·350390	0·525585	0·700780	0·875975	1·051170	1·226365	1·401561	1·576756
		NH_4Cl	1·7399733	0·549507	1·099014	1·648522	2·198029	2·747536	3·297043	3·846550	4·396057	4·945565
		$(NH_4)_2SO_4$	1·8316556	0·678665	1·357331	2·035996	2·714661	3·393326	4·071992	4·750657	5·429322	6·107988
		HNO_3	1·8111121	0·647310	1·294620	1·941930	2·589240	3·236550	3·883860	4·531170	5·178480	5·825791
		$CO(NH_2)_2$	1·4893722	0·308583	0·617166	0·925749	1·234333	1·542916	1·851499	2·160082	2·468665	2·777248
		$C_5H_4N_4O_3$	1·6351863	0·431704	0·863409	1·295113	1·726817	2·158522	2·590226	3·021930	3·453634	3·885339
Osmium	Os	$OsCl_4$	2·2411499	1·742408	3·484817	5·227225	6·969634	8·712042	10·454450	12·196859	13·939267	15·681675
		OsO_4	2·1255068	1·335079	2·670157	4·005236	5·340314	6·675393	8·010471	9·345550	10·680628	12·015707
Oxygen	H_2O	O_2	1·9484616	0·888099	1·776199	2·664298	3·552398	4·440497	5·328597	6·216696	7·104796	7·992895

Palladium	Pd	$PdCl_2$	2·2216040	1·665728	3·331455	4·997183	6·662911	8·328638	9·994366	11·660094	13·325822	14·991549
		PdI_2	2·5291941	3·382160	6·764319	10·146479	13·528638	16·910798	20·292958	23·675117	27·057277	30·439437
		$(NH_4)_2PdCl_4$	2·4266472	2·670836	5·341671	8·012507	10·683343	13·354178	16·025014	18·695850	21·366685	24·037521
		$(NH_4)_2PdCl_6$	2·5232994	3·336563	6·673127	10·009690	13·346254	16·682817	20·019380	23·355944	26·692507	30·029070
		K_2PdCl_4	2·1866666	3·066667	6·133333	9·200000	12·266667	15·333333	18·400000	21·466667	24·533333	27·600000
		K_2PdCl_6	2·5719879	3·732394	7·464789	11·197183	14·929577	18·661972	22·394366	26·126761	29·859155	33·591549
	PdI_2	Pd	1·1708059	0·295669	0·591338	0·887007	1·182676	1·478345	1·774014	2·069683	2·365352	2·661021
	$(NH_4)_2PdCl_4$	Pd	1·5733528	0·374415	0·748829	1·123244	1·497659	1·872073	2·246488	2·620903	2·995317	3·369732
	K_2PdCl_4	Pd	1·5133334	0·326087	0·652174	0·978261	1·304348	1·630435	1·956522	2·282609	2·608696	2·934783
		$PdCl_2$	1·7319374	0·543172	1·086344	1·629516	2·172688	2·715860	3·259032	3·802204	4·345377	4·888549
		K_2PdCl_6	2·0853213	1·217085	2·434170	3·651255	4·868340	6·085426	7·302511	8·519596	9·736681	10·953766
Phosphorus	P_2O_5	P	1·6401034	0·436620	0·873239	1·309856	1·746479	2·183099	2·619718	3·056338	3·492958	3·929577
		$Ca_3P_2O_8$	2·3394935	2·185211	4·370421	6·555634	8·740845	10·926056	13·111268	15·296479	17·481690	19·666901
		$Ca_2H_2P_2O_8$	2·2826254	1·917014	3·834028	5·751042	7·668056	9·585070	11·502084	13·419099	15·336113	17·253127
	$Mg_2P_2O_7$	P	1·4446325	0·278376	0·556753	0·835129	1·113506	1·391882	1·670259	1·948635	2·227012	2·505388
		P_2O_5	1·8045291	0·637572	1·275144	1·912716	2·550287	3·187859	3·825431	4·463003	5·100575	5·738147
		$Ca_3P_2O_8$	2·1440226	1·393229	2·786458	4·179687	5·572917	6·966146	8·359375	9·752604	11·145833	12·539062
		$Ca_2H_2P_2O_8$	2·0871545	1·222234	2·444468	3·666703	4·888937	6·111171	7·333405	8·555639	9·777874	11·000108
		$CaH_4P_2O_8$	2·0217016	1·051239	2·102478	3·153718	4·204957	5·256196	6·307435	7·358675	8·409914	9·461153
	$(UO_2)_2P_2O_7$	P	0·9380857	0·086713	0·173427	0·260140	0·346853	0·433566	0·520280	0·606993	0·693706	0·780420
		P_2O_5	1·2979823	0·198601	0·397203	0·595804	0·794406	0·993007	1·191608	1·390210	1·588811	1·787413
		$Ca_3P_2O_8$	1·6374758	0·433986	0·867972	1·301958	1·735944	2·169930	2·603916	3·037902	3·471888	3·905874
		$Ca_2H_2P_2O_8$	1·5806077	0·380722	0·761443	1·142165	1·522887	1·903608	2·284330	2·665052	3·045773	3·426495
		$CaH_4P_2O_8$	1·5151548	0·327457	0·654915	0·982372	1·309829	1·637287	1·964744	2·292201	2·619659	2·947116
	$Fe_2P_2O_8$	P	1·3126725	0·205434	0·410868	0·616302	0·821736	1·027170	1·232604	1·438038	1·643472	1·848907
		P_2O_5	1·6725691	0·470510	0·941021	1·411531	1·882041	2·352551	2·823062	3·293572	3·764082	4·234592
	$Pb_3P_2O_8$	P	0·8835315	0·076477	0·152954	0·229431	0·305908	0·382386	0·458863	0·535340	0·611817	0·688294
		P_2O_5	1·2434281	0·175157	0·350315	0·525472	0·700629	0·875786	1·050944	1·226101	1·401258	1·576415
	$Mg_3P_2O_8$	P	1·3723039	0·235670	0·471340	0·707009	0·942679	1·178349	1·414019	1·649688	1·885358	2·121028
		P_2O_5	1·7322005	0·539760	1·079520	1·619279	2·159039	2·698799	3·238559	3·778318	4·318078	4·857838
	Ag_3PO_4	P	0·8693654	0·074023	0·148046	0·222068	0·296091	0·370114	0·444137	0·518159	0·592182	0·666205
		P_2O_5	1·2292620	0·169536	0·339072	0·508608	0·678144	0·847680	1·017216	1·186752	1·356288	1·525824
	$Ag_4P_2O_7$	P	1·0101198	0·102358	0·204715	0·307073	0·409430	0·511788	0·614145	0·716503	0·818860	0·921218
		P_2O_5	1·3700164	0·234432	0·468863	0·703295	0·937727	1·172159	1·406590	1·641022	1·875454	2·109886
Platinum	Pt	$PtCl_4$	2·2375251	1·727926	3·455852	5·183778	6·911704	8·639630	10·367556	12·095483	13·823409	15·551335
		$(NH_4)_2PtCl_6$	2·3574456	2·277433	4·554867	6·832300	9·109733	11·387166	13·664600	15·942033	18·219466	20·496899
		K_2PtCl_6	2·3968685	2·493840	4·987680	7·481519	9·975359	12·469199	14·963039	17·456879	19·950719	22·444558
		Tl_2PtCl_6	2·6219415	4·187372	8·374743	12·562115	16·749487	20·936858	25·124230	29·311602	33·498973	37·686345
	$(NH_4)_2PtCl_6$	Pt	1·6425544	0·439091	0·878182	1·317272	1·756363	2·195454	2·634545	3·073636	3·512726	3·951817
		$PtCl_4$	1·8800795	0·758716	1·517433	2·276149	3·034866	3·793582	4·552299	5·311015	6·069732	6·828448
	K_2PtCl_6	Pt	1·6031315	0·400988	0·801976	1·202964	1·603952	2·004940	2·405928	2·806916	3·207904	3·608893
		$PtCl_4$	1·8406566	0·692878	1·385755	2·078633	2·771511	3·464389	4·157266	4·850144	5·543022	6·235900

TABLE LXXVa.—*continued.*

Element.	Found.	Sought.	Logarithm of (Factor × 100).	Factor multiplied by 1	2	3	4	5	6	7	8	9
Potassium	Tl_2PtCl_6	Pt	1·3780585	0·238813	0·477627	0·716440	0·955253	1·194066	1·432880	1·671693	1·910506	2·149320
		$PtCl_4$	1·6155836	0·412652	0·825303	1·237955	1·650607	2·063259	2·475910	2·888562	3·301214	3·713865
	K_2O	K	1·9192501	0·830329	1·660657	2·490986	3·321315	4·151644	4·981972	5·812301	6·642630	7·472959
		KCl	2·1992571	1·582185	3·164369	4·746554	6·328738	7·910923	9·493107	11·075292	12·657476	14·239661
		KBr	2·4024665	2·526193	5·052386	7·578579	10·104772	12·630965	15·157158	17·683351	20·209544	22·735737
		KI	2·5466264	3·520679	7·041357	10·562036	14·082715	17·603393	21·124072	24·644751	28·165430	31·686108
		KOH	2·0759299	1·191050	2·382100	3·573150	4·764199	5·955249	7·146299	8·337349	9·528399	10·719449
		KNO_3	2·3316559	2·146129	4·292259	6·438388	8·584517	10·730647	12·876776	15·022906	17·169035	19·315164
		K_2SO_4	2·2669352	1·848993	3·697985	5·546978	7·395970	9·244963	11·093956	12·942948	14·791941	16·640933
	KOH	K	1·8433202	0·697140	1·394280	2·091421	2·788561	3·485701	4·182841	4·879981	5·577122	6·274262
		K_2O	1·9240701	0·839595	1·679191	2·518786	3·358382	4·197977	5·037573	5·877168	6·716763	7·556359
		KCl	2·1233272	1·328395	2·656790	3·985185	5·313580	6·641974	7·970369	9·298764	10·627159	11·955554
		KNO_3	2·2557260	1·801884	3·603768	5·405652	7·207536	9·009420	10·811305	12·613189	14·415073	16·216957
	KCl	K	1·7199930	0·524799	1·049598	1·574397	2·099196	2·623995	3·148794	3·673593	4·198391	4·723190
		K_2O	1·8007429	0·632038	1·264075	1·896113	2·528150	3·160188	3·792225	4·424263	5·056300	5·688338
		KOH	1·8766728	0·752788	1·505576	2·258365	3·011153	3·763941	4·516729	5·269517	6·022306	6·775094
		KBr	2·2032094	1·596649	3·193298	4·789946	6·386595	7·983244	9·579893	11·176542	12·773190	14·369839
		KI	2·3473693	2·225201	4·450402	6·675603	8·900804	11·126005	13·351206	15·576407	17·801609	20·026810
		KNO_3	2·1323988	1·356434	2·712869	4·069303	5·425737	6·782172	8·138606	9·495040	10·851475	12·207909
		K_2SO_4	2·0676781	1·168633	2·337265	3·505898	4·674531	5·843164	7·011796	8·180429	9·349062	10·517694
		$KClO_3$	2·2157517	1·643432	3·286863	4·930295	6·573727	8·217158	9·860590	11·504021	13·147453	14·790885
		$KClO_4$	2·2690244	1·857909	3·715818	5·573727	7·431635	9·289544	11·147453	13·005362	14·863271	16·721180
	Cl	K	2·0431156	1·104372	2·208745	3·313117	4·417489	5·521862	6·626234	7·730606	8·834979	9·939351
		K_2O	2·1238655	1·330042	2·660085	3·990127	5·320169	6·650212	7·980254	9·310296	10·640338	11·970381
		KOH	2·1997954	1·584147	3·168293	4·752440	6·336587	7·920733	9·504880	11·089027	12·673173	14·257320
		KCl	2·3231226	2·104372	4·208745	6·313117	8·417489	10·521862	12·626234	14·730606	16·834979	18·939351
		$KClO_3$	2·5388743	3·458392	6·916784	10·375176	13·833568	17·291960	20·750353	24·208745	27·667137	31·125590
		$KClO_4$	2·5921470	3·909732	7·819464	11·729196	15·638928	19·548660	23·458392	27·368124	31·277856	35·187588
	K_2SO_4	K	1·6523149	0·449071	0·898142	1·347213	1·796284	2·245354	2·694425	3·143496	3·592567	4·041639
		K_2O	1·7330648	0·540835	1·081670	1·622505	2·163340	2·704175	3·245010	3·795845	4·336680	4·877515
		KOH	1·8089947	0·644161	1·288323	1·932484	2·576646	3·220807	3·864969	4·509130	5·153292	5·797453
		KCl	1·9323219	0·855701	1·711402	2·567103	3·422803	4·278504	5·134205	5·989906	6·845607	7·701308
		KNO_3	2·0647207	1·160702	2·321404	3·482106	4·642808	5·803510	6·964212	8·124914	9·285616	10·446318

	$BaSO_4$	K	1·5255493	0·335389	0·670779	1·006168	1·341557	1·676947	2·012336	2·347726	2·683115	3·018504
		K_2O	1·6062992	0·403924	0·807847	1·211771	1·615694	2·019618	2·423541	2·827465	3·231389	3·635312
		KOH	1·6822291	0·481093	0·962186	1·443279	1·924372	2·405466	2·886559	3·367652	3·848745	4·329838
		KCl	1·8055563	0·639082	1·278163	1·917245	2·556327	3·195408	3·834490	4·473571	5·112653	5·751735
		KNO_3	1·9379551	0·866872	1·733745	2·600617	3·467489	4·334361	5·201234	6·068106	6 934978	7·801850
		K_2SO_4	1·8732344	0·746852	1·493703	2·240555	2·987407	3·734258	4·481110	5·227962	5·974814	6·721665
	$KClO_4$	K	1·4509686	0·282468	0·564935	0·847403	1·129870	1·412338	1·694805	1·977273	2·259740	2·542208
		KCl	1·7309756	0·538240	1·076479	1·614719	2·152958	2·691198	3·229437	3·767677	4·305916	4·844156
	K_2PtCl_6	K	1·2073043	0·161177	0·322355	0·483532	0·644710	0·805887	0·967065	1·128242	1·289420	1·450597
		K_2O	1·2880542	0·194113	0·388226	0·582338	0·776451	0·970564	1·164677	1·358790	1·552902	1·747015
		KOH	1·3639841	0·231198	0·462396	0·693594	0·924792	1·155990	1·387188	1·618386	1·849584	2·080782
		KCl	1·4873113	0·307122	0·614245	0·921367	1·228489	1·535611	1·842734	2·149856	2·456978	2 764100
		KNO_3	1·6197101	0·416591	0·833182	1·249774	1 666365	2·082956	2·499547	2·916138	3·332730	3·719321
	K_2SiF_6	K	1·5499595	0·354780	0·709560	1·064341	1·419121	1·773901	2·128681	2·483462	2·838242	3·193022
		K_2O	1·6307094	0·427277	0·854554	1·281831	1·709107	2·136384	2·563669	2·990938	3·418215	3·845492
	$K_2Cr_2O_7$	K	1·4246765	0·265874	0·531749	0·797623	1·063497	1·329372	1·595246	1·861121	2·126995	2·392869
		K_2O	1·5054264	0·320204	0·640407	0·960611	1·280815	1·601019	1·921222	2·241426	2·561630	2·881831
Rhodium	Rh	$RhCl_3$	2·3080358	2·032524	4·065049	6·097573	8·130097	10·162621	12·195146	14·227670	16·260194	18·292718
		$(NH_4)_3RhCl_6$	2·5552660	3·591417	7·182835	10·774252	14·365670	17·957087	21·548505	25·139922	28·731340	32·322757
Rubidium	RbCl	Rb	1·8492112	0·706661	1·413322	2·119983	2·826645	3·533306	4·239967	4·946628	5·653289	6·359950
	Rb_2SO_4	Rb	1·8062044	0·640036	1·280072	1·920108	2·560144	3·200180	3·840216	4·480252	5·120288	5·760324
		RbCl	1·9569932	0·905718	1·811437	2·717155	3·622873	4·528592	5·434310	6·340028	7·245747	8·151465
	AgCl	Rb	1·7749693	0·595620	1·191240	1·786860	2·382480	2·978100	3·573720	4·169340	4·764960	5·360580
		RbCl	1·9257581	0·842865	1·685730	2·528595	3·371460	4·214326	5·057191	5·900056	6·742921	7·585786
Ruthenium	Ru	$RuCl_2$	2·2297198	1·697148	3·394297	5·091445	6·788594	8·485742	10·182891	11·880039	13·577188	15·274336
		$RuCl_3$	2·3108467	2·045723	4·091445	6·137168	8·182891	10·228614	12·274336	14·320059	16·365782	18·411504
		RuO	2·0634555	1·157325	2·314651	3·471976	4·629302	5·786627	6·943953	8·101278	9·258604	10 415929
		Ru_2O_3	2·0920143	1·235988	2·471976	3·707965	4·943953	6·179941	7·415929	8·651917	9·887906	11·123894
		RuO_2	2·1188104	1·314651	2·629302	3·943953	5·258604	6·573255	7·887906	9·202557	10·517207	11·831858
		$KRuO_4$	2·3041150	2·014258	4·028515	6·042773	8·057030	10·071288	12·085546	14·099803	16·114061	18 128319
Samarium	Sm_2O_3	Sm	1·9355420	0·862069	1·724138	2·586207	3·448276	4·310345	5·172414	6·034483	6·896552	7·758621
Scandium	Sc_2O_3	Sc	1·8112915	0·647577	1·295154	1·942731	2·590308	3·237885	3·885463	4·533040	5·180617	5·828194
		$Sc_2(SO_4)_3$	2·4414494	2·763436	5·526872	8·290308	11·053744	13·817181	16·580617	19·344053	22·107489	24·870925
		$Sc_2(SO_4)_3+6H_2O$	2·5510952	3·557093	7·114185	10·671278	14·228370	17·785463	21·342555	24·899648	28·156740	32·013833
Selenion	Se	SeO_2	2·1473796	1·404040	2·808081	4·212121	5·616162	7·020202	8·424242	9·828283	11·232323	12·636364
		SeS_2	2·2575816	1·809596	3·619192	5·428788	7·238384	9·047980	10·857576	12·667172	14·476768	16·286364
		$SeCl_2$	2·2776555	1·895202	3·790404	5·685606	7·580808	9·476010	11·371212	13·266414	15·161616	17·056818
	SeS_2	Se	1·7424184	0·552610	1·105219	1·657829	2·210438	2·763048	3·315657	3·868267	4·420876	4·973486
		SeO_2	1·8897980	0·775386	1·551772	2·327658	3·103545	3·879431	4·655317	5·431203	6·207089	6·982975
		$SeCl_2$	2·0200739	1·047307	2·094613	3·141920	4·189227	5·236534	6·283840	7·331147	8·378454	9·425760

TABLE LXXVA.—*continued.*

Element.	Found.	Sought.	Logarithm of (Factor × 100).	Factor multiplied by 1	2	3	4	5	6	7	8	9
Silicon	SiO_2	Si	1·6722814	0·470199	0·940397	1·410596	1·880795	2·350993	2·821192	3·291391	3·761589	4·231788
		SiF_4	2·2376626	1·728477	3·456954	5·185430	6·913907	8·642384	10·370861	12·099338	13·827815	15·556291
		$SiCl_4$	2·4499227	2·817881	5·635762	8·453642	11·271523	14·089404	16·907285	19·725166	22·543046	25·360927
		H_2SiF_6	2·3785784	2·390993	4·781987	7·172980	9·563974	11·954967	14·345960	16·736954	19·127947	21·518940
		K_2SiF_6	2·5627654	3·653974	7·307947	10·961921	14·615894	18·269868	21·923841	25·577815	29·231788	32·885762
		$BaSiF_6$	2·6658108	4·632450	9·264901	13·897351	18·529801	23·162252	27·794702	32·427152	37·059603	41·692053
	K_2SiF_6	Si	1·1095160	0·128681	0·257363	0·386044	0·514726	0·643407	0·772089	0·900770	1·029452	1·158133
		SiO_2	1·4372346	0·273675	0·547349	0·821024	1·094699	1·368373	1·642048	1·915723	2·189397	2·463072
		SiF_4	1·6748982	0·473040	0·946081	1·419121	1·892161	2·365202	2·838242	3·311282	3·784323	4·257363
		$SiCl_4$	1·8871573	0·771183	1·542365	2·313548	3·084730	3·855913	4·627096	5·398278	6·169461	6·940643
	$BaSiF_6$	Si	1·0064706	0·101501	0·203002	0·304503	0·406004	0·507505	0·609006	0·710507	0·812009	0·913510
		SiO_2	1·3341892	0·215868	0·431737	0·647605	0·863474	1·079342	1·295211	1·511079	1·726948	1·942816
		SiF_4	1·5718528	0·373124	0·746247	1·119371	1·492495	1·865618	2·238742	2·611865	2·984989	3·358113
		$SiCl_4$	1·7841119	0·608292	1·216583	1·824875	2·433167	3·041458	3·649750	4·258041	4·866333	5·474625
Silver	Ag	Ag_2O	2·0310536	1·074122	2·148244	3·222336	4·296488	5·370611	6·444733	7·518855	8·592977	9·667099
		Ag_2S	2·0601394	1·148522	2·297044	3·445567	4·594089	5·742611	6·891133	8·039655	9·188178	10·336700
		AgCl	2·1233464	1·328454	2·656907	3·985361	5·313814	6·642268	7·970722	9·299175	10·627629	11·956083
		AgBr	2·2407615	1·740851	3·481701	5·222552	6·963402	8·704253	10·445103	12·185954	13·926804	15·667655
		AgI	2·3375189	2·175299	4·350598	6·525896	8·701195	10·876494	13·051793	15·227092	17·403390	19·577689
		AgCN	2·0938654	1·241267	2·482535	3·723802	4·965070	6·206337	7·447605	8·688872	9·930140	11·171407
		$AgNO_3$	2·1972301	1·574817	3·149634	4·724451	6·299268	7·874085	9·448902	11·023719	12·598536	14·173353
	AgCl	Ag	1·8766536	0·752755	1·505510	2·258265	3·011020	3·763775	4·516529	5·269284	6·022039	6·774794
		Ag_2O	1·9077072	0·808551	1·617101	2·425652	3·234203	4·042753	4·851304	5·659855	6·468406	7·276956
		Ag_2S	1·9367930	0·864556	1·729111	2·593667	3·458223	4·322779	5·187334	6·051890	6·916446	7·781001
		$AgNO_3$	2·0738837	1·185451	2·370902	3·556354	4·741805	5·927256	7·112707	8·298159	9·483610	10·669061
	AgBr	Ag	1·7592385	0·574432	1·148864	1·723296	2·297727	2·872159	3·446591	4·021023	4·595455	5·169887
		Ag_2O	1·7902921	0·617010	1·234020	1·851030	2·468040	3·085050	3·702060	4·319070	4·936080	5·553090
		$AgNO_3$	1·9564686	0·904625	1·809250	2·713875	3·618500	4·523125	5·427750	6·332375	7·237000	8·141625
	AgI	Ag	1·6624811	0·459707	0·919414	1·379121	1·838828	2·298535	2·758242	3·217949	3·677656	4·137363
		Ag_2O	1·6935347	0·493781	0·987563	1·481344	1·975126	2·468907	2·962688	3·456470	3·950251	4·444033
		$AgNO_3$	1·8597112	0·723954	1·447909	2·171863	2·895817	3·619772	4·343726	5·067680	5·791635	6·515589
	Ag_2S	Ag	1·9398606	0·870684	1·741368	2·612052	3·482736	4·353420	5·224105	6·094789	6·965473	7·836157
		Ag_2O	1·9709142	0·935221	1·870442	2·805663	3·470884	4·676105	5·611326	6·546547	7·481768	8·416989
		$AgNO_3$	2·1370907	1·371168	2·742336	4·113504	5·484672	6·855841	8·227009	9·598177	0·969345	12·340513

Sodium	AgCN	Ag	1·9061346	0·805628	1·611256	2·416884	3·222512	4·028141	4·833769	5·639397	6·445025	7·250653
		Ag_2O	1·9371882	0·865343	1·730686	2·596029	3·461372	4·326715	5·192058	6·057401	6·922744	7·788087
		$AgNO_3$	2·1033647	1·268717	2·537434	3·806151	5·074868	6·343584	7·612301	8·881018	10·149735	11·418452
	Ag_3PO_4	Ag	1·8882672	0·773156	1·546312	2·319468	3·092624	3·865780	4·638936	5·412092	6·185248	6·958404
		Ag_2O	1·9193208	0·830464	1·660928	2·491392	3·321856	4·152320	4·982784	5·813248	6·643712	7·474176
		$AgNO_3$	2·0854973	1·217579	2·435158	3·652738	4·870317	6·087896	7·305475	8·523054	9 740634	10·958213
	$Ag_4P_2O_7$	Ag	1·8529303	0·712739	1·425477	2·138216	2·850954	3·563693	4·276431	4·989170	5·701908	6·414647
		Ag_2O	1·8839839	0·765568	1·531136	2·296705	3·062273	3·827841	4·593409	5·358978	6·124546	6·890114
		$AgNO_3$	2·0501604	1·122433	2·244866	3·367298	4·489731	5·612164	6·734597	7·857030	8·979462	10·101895
	Na_2O	Na	1·8706093	0·742351	1·484702	2·227053	2·969404	3·711755	4·454106	5·196457	5·938808	6·681159
		NaOH	2·1106277	1·290113	2·580225	3·870338	5·160451	6·450564	7·740676	9·030789	10·320902	11·611014
		NaCl	2·2750943	1·884058	3·768116	5·652174	7·536232	9·420290	11·304348	13·188406	15·072464	16·956522
		Na_2CO_3	2·2326238	1·708535	3·417069	5·125604	6·834139	8·542673	10·251208	11·959742	13·668277	15·376812
		Na_2SO_4	2·3596858	2·289211	4·578422	6·867633	9·156844	11·446055	13·735266	16·024477	18·313688	20·602899
		$NaNO_3$	2·4378169	2·740419	5·480837	8·221256	10·961675	13·702093	16·442512	19·182931	21·923349	24·663768
		$Na_2H_2Sb_2O_7$	2·8095283	6·449533	12·899066	19·348599	25·798132	32·247665	38·697198	45·146731	51·596264	58·045797
	NaOH	Na	1·7599816	0·575416	1·150831	1·726247	2·301663	2·877078	3·452494	4·027909	4·603325	5·178741
		Na_2O	1·8893723	0·775126	1·550252	2·325378	3·100504	3·875630	4·650756	5·425882	6·201008	6·976135
		NaCl	2·1644666	1·460382	2·920765	4·381147	5·841530	7·301912	8·762295	10·222677	11·683060	13·143442
		Na_2CO_3	2·1219961	1·324330	2·648659	3·972989	5·297319	6·621649	7·945978	9·270308	10·594638	11·918967
		Na_2SO_4	2·2490581	1·774427	3·548854	5·323281	7·097708	8·872135	10·646562	12·420990	14·195417	15·969844
		$NaNO_3$	2·3271892	2·124170	4·248340	6·372510	8·496680	10·620850	12·745020	14·869190	16·993360	19·117530
		$Na_2H_2Sb_2O_7$	2·6989006	4·999201	9·998402	14·997603	19·996805	24·996006	29·995207	34·994408	39·993609	44·992810
	NaCl	Na	1·5955150	0·394017	0·788034	1·182051	1·576068	1·970085	2·364103	2·758120	3·152137	3·546154
		Na_2O	1·7249057	0·530769	1·061538	1·592308	2·123077	2·653846	3·184615	3·715385	4·246154	4·776923
		NaOH	1·8355334	0·684752	1·369504	2·054256	2·739009	3·423761	4·108513	4·793265	5·478017	6·162769
		Na_2CO_3	1·9575295	0·906838	1·813675	2·720513	3·627350	4·534188	5·441026	6·347863	7·254701	8·161538
		$NaNO_3$	2·1627226	1·454530	2·909060	4·363590	5·818120	7 272650	8·727179	10·181709	11·636239	13·090769
	Cl	Na	1·8130547	0·650212	1·300423	1·950635	2·600846	3·251058	3·901269	4·551481	5·201692	5·851904
		NaOH	2·0530731	1·129986	2·259972	3·389958	4·519944	5·649929	6·779915	7·909901	9·039887	10·169873
		NaCl	2·2175397	1·650212	3·300423	4·950635	6·600846	8·251058	9·901269	11·551481	13·201692	14·851904
	AgCl	Na	1·2061823	0·160762	0·321523	0·482285	0·643046	0·803808	0·964570	1·125331	1·286093	1·446854
		NaCl	1·6106673	0·408007	0·816013	1·224020	1·632027	2·040033	2·448040	2·856047	3·264054	3·672060
	Na_2SO_4	Na	1·5109235	0·324282	0·648565	0·972847	1·297130	1·621412	1·945695	2·269977	2·594260	2·918542
		NaOH	1·7509419	0·563562	1·127124	1·690687	2·254249	2·817811	3·381373	3·944935	4·508497	5·072060
		Na_2CO_3	1·8729380	0·746342	1·492684	2·239026	2·985369	3·731711	4·478053	5·224395	5·970737	6·717079
		NaCl	1·9154085	0·823016	1·646033	2·469049	3·292065	4·115082	4·938098	5·761114	6·584131	7·407147
		$NaNO_3$	2·0781311	1·197102	1·394204	3·591306	4·788407	5·985509	7·182611	8·379713	9·576815	10·773917
	Na_2CO_3	Na	1·6379855	0·434496	0·868992	1·303487	2·737983	2·172479	2·606975	3·041470	3·475966	3·910462
		NaOH	1·8780039	0·755099	1·510198	2·265297	4·020396	3·775495	4·530594	5·285693	6·040792	6·795891
	$Na_2H_2Sb_2O_7$	Na	1·0610810	0·115102	0·230203	0·345305	0·460406	0·575508	0·690609	0·805711	0·920812	1·035914
		Na_2O	1·1904717	0·155050	0·310100	0·465150	0·620200	0·775250	0·930300	1·085350	1·240400	1·395450

TABLE LXXVA.—*continued.*

Element.	Found.	Sought.	Logarithm of (Factor × 100).	Factor multiplied by 1	2	3	4	5	6	7	8	9
		NaOH	1·3010994	0·200032	0·400064	0·600096	0·800128	1·000160	1·200192	1·400224	1·600256	1·800288
		Na_2CO_3	1·4230955	0·264908	0·529817	0·794725	1·059633	1·324541	1·589450	1·854358	2·119266	2·384174
		NaCl	1·4655660	0·292123	0·584246	0·876369	1·168493	1·460616	1·752739	2·044862	2·336985	2·629108
Strontium	SrO	Sr	1·9271443	0·845560	1·691120	2·536680	3·382239	4·227799	5·073359	5·918919	6·764479	7·610039
		$Sr(OH)_2$	2·0696309	1·173900	2·347799	3·521699	4·695598	5·869498	7·043398	8·217297	9·391197	10·565096
		$SrCO_3$	2·1537266	1·424710	2·849421	4·274131	5·698842	7·123552	8·548263	9·972973	11·397683	12·822394
		$SrCl_2$	2·1846695	1·529923	3·059856	4·589768	6·119691	7·649614	9·179537	10·709459	12·239382	13·769305
		$Sr(NO_3)_2$	2·3103200	2·043243	4·086486	6·129730	8·172973	10·216216	12·259459	14·302703	16·345946	18·389189
	$SrSO_4$	Sr	1·6784895	0·476968	0·953937	1·430905	1·907873	2·384842	2·861810	3·338778	3·815746	4·292715
		SrO	1·7513452	0·564086	1·128172	1·692257	2·256343	2·820429	3·384515	3·948601	4·512686	5·076772
		$SrCl_2$	1·9360147	0·863008	1·726015	2·589023	3·452031	4·315039	5·178046	6·041054	6·904062	7·767070
	$SrCO_3$	Sr	1·7734177	0·593496	1·186992	1·780488	2·373984	2·967480	3·560976	4·154472	6·747967	5·341463
		SrO	1·8462734	0·701897	1·403794	2·105691	2·807588	3·509485	4·211382	4·913279	5·615176	6·317073
	$SrCl_2$	Sr	1·7424748	0·552681	1·105363	1·658044	2·210726	2·763407	3·316088	3·868770	4·421451	4·974133
		SrO	1·8153305	0·653628	1·307256	1·960883	2·614511	3·268139	3·921767	4·575394	5·229022	5·882650
	$Sr(NO_3)_2$	Sr	1·6168243	0·413832	0·827664	1·241497	1·655329	2·069161	2·482993	2·896825	3·310658	3·724490
		SrO	1·6896800	0·489418	0·978836	1·468254	1·957672	2·447090	2·936508	3·425926	3·915344	4·404762
Sulphur	$BaSO_4$	S	1·1377510	0·137325	0·274651	0·411976	0·549302	0·686627	0·823953	0·961278	1·098604	1·235929
		H_2S	1·1642361	0·145961	0·291922	0·437882	0·583843	0·729804	0·875765	1·021725	1·167686	1·313647
		SO_2	1·4383744	0·274394	0·548788	0·823182	1·097576	1·371969	1·646363	1·920757	2·195151	2·469545
		SO_3	1·5352031	0·342928	0·685856	1·028784	1·371712	1·714641	2·057569	2·400497	2·743425	3·086353
		SO_4	1·6143301	0·411462	0·822925	1·234387	1·645849	2·057312	2·468774	2·850236	3·291699	3·703161
		H_2SO_4	1·6233502	0·420098	0·840195	1·260293	1·680391	2·100488	2·520586	2·940684	3·360781	3·780879
		S_2Cl_2	1·4611556	0·289172	0·578343	0·867515	1·156686	1·445858	1·735030	2·024191	2·313363	2·602534
	As_4S_6	S	1·5918320	0·390690	0·781379	1·172069	1·562759	1·953449	2·344138	2·734828	3·125518	3·516208
		H_2S	1·6183171	0·415257	0·830514	1·245771	1·661029	2·076286	2·491543	2·906800	3·322057	3·737314
	CdS	S	1·3462159	0·221930	0·443860	0·665790	0·887720	1·109650	1·331580	1·553510	1·775440	1·997369
		H_2S	1·3727010	0·235885	0·471771	0·707656	0·943541	1·179427	1·415312	1·651198	1·887083	2·122968
Tantalum	Ta_2O_5	Ta	1·9141462	0·820628	1·641256	2·461883	3·282511	4·103139	4·923767	5·744395	6·565022	7·385650
		$TaCl_5$	2·2082991	1·615471	3·230942	4·846413	6·461883	8·077354	9·692825	11·308296	12·923767	14·539238
Tellurium	Te	TeO_2	2·0971822	1·250784	2·501567	3·752351	5·003135	6·253918	7·504702	8·755486	10·006270	11·257053
		$TeCl_2$	2·1919098	1·555643	3·111285	4·666928	6·222571	7·778213	9·333856	10·889498	12·445141	14·000784

		$TeCl_4$	2·3245469	2·111285	4·222571	6·333856	8·445141	10·556426	12·667712	14·778997	16·890282	19·001567
		H_2TeO_4	2·1810905	1·517367	3·034734	4·552100	6·069467	7·586834	9·104201	10·621567	12·138934	13·656301
	TeO_2	Te	1·9028178	0·799499	1·598997	2·398496	3·197995	3·997494	4·796992	5·596491	6·395990	7·195489
		H_2TeO_4	2·0839083	1·213133	2·426266	3·639398	4·852531	6·065664	7·278797	8·491930	9·705063	10·918195
Terbium	Rarely met.											
Thallium	TlI	Tl	1·7900806	0·616709	1·233419	1·850128	2·466838	3·083547	3·700257	4·316966	4·933676	5·550385
		Tl_2O	1·8067783	0·640882	1·281765	1·922647	2·563529	3·204412	3·845294	4·486176	5·127058	5·767941
		TlCl	1·8596338	0·723825	1·447651	2·171476	2·895301	3·619127	4·342952	5·066777	5·790603	6·514428
	Tl_2PtCl_6	Tl	1·6993425	0·500429	1·000858	1·501287	2·001716	2·502145	3·002574	3·503004	4·003433	4·503862
		Tl_2O	1·7160402	0·520044	1·040088	1·560132	2·080177	2·600221	3·120265	3·640309	4·160353	4·680397
		TlCl	1·7688957	0·587348	1·174697	1·762045	2·349393	2·936741	3·524090	4·111438	4·698786	5·286135
Thorium	ThO_2	Th	1·9439973	0·879017	1·758034	2·637051	3·516068	4·395085	5·274102	6·153119	7·032136	7·911153
		$Th(SO_4)_2$	2·2055747	1·605386	3·210772	4·816159	6·421545	8·026931	9·632317	11·237703	12·843090	14·448476
		$Th(SO_4)_2+9H_2O$	2·3460378	2·218389	4·436779	6·655168	8·873558	11·091947	18·310336	15·528726	17·747115	19·965505
Thulium	Rarely met.											
Tin	SnO_2	Sn	1·8965701	0·788079	1·576159	2·364238	3·152318	3·940397	4·728477	5·516556	6·304636	7·092715
		$SnCl_2$	2·0995481	1·257616	2·515232	3·772848	5·030464	6·288079	7·545695	8·803311	10·060927	11·318543
		$SnCl_2+2H_2O$	2·1750008	1·496238	2·992477	4·488715	5·984954	7·481192	8·977430	10·473669	11·969907	13·466146
		$SnCl_4$	2·2373307	1·727152	3·454305	5·181457	6·908609	8·635762	10·362914	12·090066	13·817219	15·544371
		$SnCl_4+5H_2O$	2·3661817	2·323709	4·647417	6·971126	9·294834	11·618543	13·942252	16·265960	18·589669	20·913377
		SnS_2	2·0837589	1·212715	2·425430	3·638146	4·850861	6·063576	7·276291	8·489007	9·701722	10·914437
Titanium	TiO_2	Ti	1·7785126	0·600499	1·200999	1·801498	2·401997	3·002497	3·602996	4·203496	4·803995	5·404494
		$TiCl_4$	2·3748925	2·370786	4·741573	7·112359	9·483146	11·853932	14·224719	16·595505	18·966292	21·337078
		TiF_4	2·1901393	1·549313	3·098627	4·647940	6·197253	7·746567	9·295880	10·845194	12·394507	13·943820
		K_2TiF_6	2·4773020	3·001248	6·002497	9·003745	12·004994	15·006242	18·007491	21·008739	24·009988	27·011236
Tungsten	WO_3	W	1·8993298	0·793103	1·586207	2·379310	3·172414	3·965517	4·758621	5·551724	6·344828	7·137931
		WCl_6	2·2329742	1·709914	3·419828	5·129741	6·839655	8·549569	10·259483	11·969397	13·679310	15·389224
		$Na_2WO_4+2H_2O$	2·1531996	1·422983	2·845966	4·268948	5·691931	7·114914	8·537897	9·960879	11·383862	12·806845
		$CaWO_4$	2·0940553	1·241810	2·483621	3·725431	4·967241	6·209052	7·450862	8·692672	9·934483	11·176293
Uranium	U_3O_8	U	1·9285245	0·848251	1·696503	2·544754	3·393005	4·241257	5·089508	5·937759	6·786011	7·634262
		UO_2	1·9832934	0·962063	1·924126	2·886188	3·848251	4·810314	5·772377	6·734440	7·696503	8·658565
		UO_3	2·0081608	1·018969	2·037937	3·056906	4·075874	5·094843	6·113811	7·132780	8·151749	9·170747
		UCl_4	2·1311625	1·352579	2·705157	4·057736	5·410314	6·762893	8·115471	9·468050	10·820628	12·173207
		$UO_2(NO_3)_2+6H_2O$	2·2523243	1·787822	3·575644	5·363467	7·151289	8·939111	10·726933	12·514755	14·302577	16·090400
		$UO_2SO_4+3H_2O$	2·1749137	1·495938	2·991877	4·487815	5·983753	7·179692	8·975630	10·471568	11·967507	13·463445
		$(UO_2)_2P_2O_7$	2·1043122	1·271488	2·542976	3·814464	5·085951	6·357439	7·628927	8·900415	10·171903	11·443391
		$K_2U_2O_7$	2·0743273	1·186663	2·373325	3·559988	4·746651	5·933314	7·119976	8·306639	9·493302	10·679964
	$(UO_2)_2P_2O_7$	U	1·8242123	0·667133	1·334266	2·001399	2·668531	3·335664	4·002797	4·669930	5·337063	6·004196
		UO_2	1·8788912	0·756643	1·513287	2·269930	3·026573	3·783217	4·539860	5·296504	6·053147	6·809790
		U_3O_8	1·8956878	0·786480	1·572960	2·359441	3·145921	3·932401	4·718881	5·505361	6·291842	7·078322
	$K_2U_2O_7$	U	1·8541972	0·714821	1·429642	2·144463	3·859284	3·574105	4·288926	5·003746	5·718567	6·433388

TABLE LXXVa.—*continued.*

Element.	Found.	Sought.	Logarithm of (Factor × 100).	Factor multiplied by 1	2	3	4	5	6	7	8	9
Uranium		UO_2	1·9088761	0·810730	1·621460	2·432189	3·242919	4·053649	4·864379	5·675109	6·485838	7·296568
		UO_3	1·9338335	0·858684	1·717368	2·576053	3·434737	4·293421	5·152105	6·010790	6·869474	7·728158
Vanadium	V_2O_5	V	1·7492752	0·561404	1·122807	1·684211	2·245614	2·807018	3·368421	3·929825	4·491228	5·052632
		VCl_4	2·3255625	2·116228	4·232456	6·348684	4·464912	10·581140	12·697368	14·813596	16·929825	19·046053
		$NaVO_3$	2·1272541	1·340461	2·680921	4·021382	5·361842	6·702303	8·042763	9·383224	10·723684	12·064145
		$Pb(VO_3)_2$	2·3467518	2·222039	4·444079	6·666118	8·888158	11·110197	13·332237	15·554276	17·776316	19·998355
Ytterbium	Yb_2O_3	Yb	1·9435799	0·878173	1·756345	2·634518	3·512690	4·390863	5·269036	6·147208	7·025381	7·903553
		$Yb_2(SO_4)_3$	2·2067163	1·609594	3·219188	4·828782	6·438376	8·047969	9·657563	11·267157	12·876751	14·486345
		$Yb_2(SO_4)_3+8H_2O$	2·2956553	1·975401	3·950802	5·926203	7·901604	9·877005	11·852406	13·827807	15·803208	17·778609
Yttrium	Y_2O_3	Y	1·8963116	0·787611	1·575221	2·362832	3·150442	3·938053	4·725664	5·513274	6·300885	7·088496
		$Y_2(SO_4)_3$	2·3744452	2·062743	4·125487	6·188230	8·250973	10·313717	12·376460	14·439204	16·501947	18·564690
		$Y_2(SO_4)_3+8H_2O$	2·4314407	2·700478	5·400956	8·101434	10·801912	13·502389	16·202867	18·903345	21·603823	24·304301
Zinc	ZnO	Zn	1·9049533	0·803440	1·606880	2·410319	3·213759	4·017199	4·820639	5·624079	6·427518	7·230958
		$ZnCO_3$	2·1876731	1·540541	3·081081	4·621622	6·162162	7·702703	9·243243	10·783784	12·324324	13·864865
		ZnS	2·0782020	1·197297	2·394595	3·591892	4·789189	5 986486	7·183784	8·381081	9·578378	10·775676
		$ZnSO_4$	2·2974405	1·983538	3·967076	5·950614	7·934152	9·917690	11·901228	13·884767	15·868305	17·851843
		$ZnSO_4+7H_2O$	2·5481222	3·532826	7·065651	10·598477	14·131302	17·664128	21·196953	24·729779	28·262604	31·795430
		$ZnCl_2$	2·2238715	1·674447	3·348894	5·023342	6·697789	8·372236	10·046683	11·721130	13·395577	15·070025
		$ZnCl_2,3ZnO+4H_2O$	2·7450556	5·559754	11·119509	16·679263	22·239018	27·798772	33·358527	38·918281	44·478035	50·037790
	$ZnCO_3$	Zn	1·7172802	0·521531	1·043062	1·564593	2·086124	2·607655	3·129187	3·650718	4·172249	4·693780
		ZnO	1·8123269	0·649123	1·298246	1·947368	2·596491	3·245614	3·894737	4·543860	5·192982	5·842105
		ZnS	1·8905289	0·777193	1·554386	2·331579	3·108772	3·885965	4·663158	5·440351	6·217544	6·994737
		$ZnSO_4$	2·1097674	1·287560	2·575120	3·862679	5·150239	6·437799	7·725359	9·012919	10·300478	11·588038
	ZnS	Zn	1·8267513	0·671045	1·342089	2·013134	2·684178	3·355223	4·026267	4·697312	5·368356	6·039401
		ZnO	1·9217980	0·835214	1·670429	2·505643	3·340858	4·176072	5·011287	5·846501	6·681716	7·516930
		$ZnSO_4$	2·2192185	1·656680	3·313359	4·970039	6·626719	8·283398	9·940078	11·596758	13·253437	14·910117
	$ZnSO_4$	Zn	1·6075128	0·405054	0·810108	1·215162	1·620216	2·025269	2·430323	2·835377	3·240431	3·645485
		ZnO	1·7025595	0·504150	1·008299	1·512449	2·016599	2·520748	3·024898	3·529047	4·033197	4·537347
		ZnS	1·7807615	0·603617	1·207234	1·810859	2·414468	3·018085	3·621702	4·225319	4·828936	5·432553
Zirconium	ZrO_2	Zr	1·8686377	0·738989	1·477977	2·216966	2·955954	3·694943	4·433931	5·172920	5·911909	6·650897
		ZrF_4	2·1331845	1·358891	2·717781	4·076672	5·435563	6·794453	8·153344	9·512235	10·871126	12·230016
		$ZrCl_4$	2·2777456	1·895595	3·791191	5·686786	7·582382	9·477977	11·373573	13·269168	15·164763	17·060359
		K_2ZrF_6	2·3631424	2·307504	4·615008	6·922512	9·230016	11·537520	13·845024	16·152529	18·460033	20·767537
		$ZrSiO_4$	2·1739606	1·492659	2·985318	4·477977	5·970636	7·463295	8·955954	10·448613	11·941272	13·433931

TABLE LXXVB (1).—Volumetric Analysis.

The first column gives the formula of the substance to be estimated; the second column gives in milligrammes the weight of the substance corresponding to each centimetre cube of decinormal solution; and the third column contains the logarithms of the numbers in column 2.

By taking for assay as many decigrammes as there are mgms. represented in column 2, each c.cm. of $\frac{N}{10}$ solution will correspond to 1 per cent. of the substance whose formula is given in column 1. For example, if one wished to ascertain the percentage of Na_2CO_3 in soda crystals, one would weigh out exactly 5·305 decigrammes, *i.e.*, 0·5305 grm., of the crystals, dissolve this amount in water and neutralise with $\frac{N}{10}$ acid: each c.cm. of acid required will represent 1 per cent. of Na_2CO_3 in the crystals, so that, if it needed 37·8 c.cms. acid, the crystals would contain 37·8 per cent. of Na_2CO_3 In this way all trouble in calculating out the results of volumetric determinations can be avoided.

This Table B (1) gives all the normal values for precipitation, acidimetry, alkalimetry, oxidation, reduction, and iodometric methods; some slightly abnormal values are given in Table B (2).

Formula of Substance to be estimated.	Weight, in mgms., of Substance ≡ 1 cm.³ $\frac{N}{10}$ Solution.	Logarithm.
Aluminium—		
$Al^{\cdots}$,	0·903$\dot{3}$	$\bar{1}$·9558480
$AlBr_3 + 6H_2O$,	12·5025$\dot{3}$	1·0969980
$AlCl_3$,	4·448$\dot{3}$	0·6481973
$AlCl_3 + 6H_2O$,	8·0515$\dot{3}$	0·9058787
Al_2O_3,	1·703$\dot{3}$	0·2312996
$Al(OH)_3$,	2·6041$\dot{3}$	0·4156632
$AlPO_4$,	4·07	0·6095944
$Al_2(SO_4)_3$,	5·706$\dot{3}$	0·7563571
$Al_2(SO_4)_3 + 18H_2O$,	11·1111$\dot{3}$	1·0457583
$(NH_4)_2Al_2(SO_4)_4 + 24H_2O$,	15·1161$\dot{3}$	1·1794406
$K_2Al_2(SO_4)_4 + 24H_2O$,	15·8187$\dot{3}$	1·1991716
$Na_2Al_2(SO_4)_4 + 24H_2O$,	15·2820$\dot{6}$	1·1841820
Antimony—		
$Sb^{\cdots}$,.	4·006$\dot{6}$	0·6027832
$SbBr_3$,	12·002$\dot{6}$	1·0792777
$SbCl_3$,	7·551$\dot{6}$	0·8780428
SbF_3,	5·906$\dot{6}$	0·7713424
Sb_2O_3,	4·806$\dot{6}$	0·6818440
Sb_2S_3,	5·609$\dot{6}$	0·7489370
$K_2Sb_2O_2(C_4H_4O_6)_2 + H_2O$,	22·159$\dot{3}$	1·3455566
$Sb^{\cdots\cdots}$,	2·404	0·3809345
$SbCl_5$,	5·949	0·7744440
SbF_5,	4·304	0·6338723
Sb_2O_5,	3·204	0·5056925
Sb_2S_5,	4·007	0·6028193

TABLE LXXVB (1).—*continued.*

Formula of Substance to be estimated.	Weight, in mgms., of Substance ≡ 1 cm.³ $\frac{N}{10}$ Solution.	Logarithm.
Arsenic—		
$As^{\cdots}$,	2·5	0·3979400
$AsCl_3$,	6·045	0·7813963
As_4O_6,	3·3	0·5185140
As_4S_6,	4·103	0·6131016
Na_2HAsO_3,	5·6702$\dot{6}$	0·7536034
$Na_2HAsO_4 + 12H_2O$,	13·41	1·1139434
$As^{\cdots\cdot}$,	1·5	0·1760913
As_2O_5,	2·3	0·3617278
As_2S_5,	3·103	0·4917818
Barium—		
$Ba^{\cdot\cdot}$,	6·87	0·8369567
$BaBr_2$,	14·866	1·1721941
$BaBr_2 + 2H_2O$,	16·6676	1·2218731
$BaCO_3$,	9·87	0·9943171
$Ba(ClO_3)_2$,	15·215	1·1822720
$BaCl_2$,	10·415	1·0176593
$BaCl_2 + 2H_2O$,	12·2166	1·0869504
$BaCrO_4$,	12·675	1·1029480
$Ba(NO_3)_2$,	13·074	1·1164085
BaO,	7·67	0·8847954
$Ba(OH)_2$,	8·5708	0·9330214
$Ba(OH)_2 + 8H_2O$,	15·7772	1·1980299
BaO_2,	8·47	0·9278834
$BaO_2 + 8H_2O$,	15·6764	1·1952463
$BaSO_4$,	11·673	1·0671825
$BaPtC_4N_4 + 4H_2O$,	25·4212	1·4051960
Beryllium (Glucinum)—		
$Be^{\cdot\cdot}$ ($Gl^{\cdot\cdot}$),	0·455	$\bar{1}$·6580114
$BeCl_2$,	4·	0·6020600
$BeCl_2 + 4H_2O$,	7·6032	0·8809964
BeO,	1·255	0·0986437
$BeSO_4$,	5·258	0·7206206
$BeSO_4 + 4H_2O$,	8·8612	0·9474925
Bismuth—		
$Bi^{\cdots}$,	6·95	0·8419848
$BiCl_3$,	10·495	1·0209824
BiI_3,	19·635	1·2930309
$Bi(NO_3)_3$,	13·154	1·1190578
$Bi(NO_3)_3 + 5H_2O$,	16·156$\dot{6}$	1·2083517
$BiPO_4$,	10·116$\dot{6}$	1·0050374
Bi_2O_3,	7·75	0·8893017
$BiAsO_4$,	11·583$\dot{3}$	1·0638335
Bi_2S_3,	8·553	0·9321184

TABLE LXXVB (1).—*continued.*

Formula of Substance to be estimated.	Weight, in mgms., of Substance ≡ 1 cm.^{3} $\frac{N}{10}$ Solution.	Logarithm.
Boron—		
$B^{\cdots}$,	0·366$\dot{6}$	$\bar{1}$·5642714
B_2O_3,	1·166$\dot{6}$	0·0669467
H_3BO_3,	2·0674$\dot{6}$	0·3154385
Bromine—		
Br',	7·996	0·9028728
HBr,	8·0968	0·9083134
Br_2O_5,	11·996	1·0790365
$HBrO_3$,	12·8968	1·1104820
KBr,	11·911	1·0759482
$AgBr$,	18·789	1·2739037
$NaBr$,	10·301	1·0128794
Cadmium—		
$Cd^{\cdot\cdot}$,	5·62	0·7497363
$CdCO_3$,	8·62	0·9355073
$CdCl_2$,	9·165	0·9621325
$CdCl_2 + 2H_2O$,	10·9666	1·0400720
CdI_2,	18·305	1·2625697
$Cd(NO_3)_2$,	11·824	1·0727644
$Cd(NO_3)_2 + 4H_2O$,	15·4272	1·1882871
CdO,	6·42	0·8075350
$CdSO_4$,	10·423	1·0179927
$CdSO_4 + 4H_2O$,	14·0262	1·1469400
CdS,	7·223	0·8587176
Cæsium—		
$Cs^{\cdot}$,	13·29	1·1235250
Cs_2CO_3,	16·29	1·2119211
$CsCl$,	16·835	1·2262131
$CsNO_3$,	19·494	1·2899010
Cs_2SO_4,	18·093	1·2575106
Cs_2PtCl_6,	33·665	1·5271786
Calcium—		
$Ca^{\cdot\cdot}$,	2·005	0·3021144
$Ca_3(AsO_4)_2$,	6·638$\dot{3}$	0·8220590
$CaBr_2$,	10·001	1·0000434
$CaCO_3$,	5·005	0·6994041
$Ca(ClO_3)_2$,	10·35	1·0149403
$CaCl_2$,	5·55	0·7442930
$CaCl_2 + 6H_2O$,	10·9548	1·0396045
CaF_2,	3·905	0·5916210
$Ca(OCl)_2$,	7·15	0·8543060
$Ca(H_2PO_2)_2$,	8·5066	0·9297560
$Ca(NO_3)_2$,	8·209	0·9142903
$Ca(NO_3) + 4H_2O$,	11·8122	1·0723308

TABLE LXXVB (1).—*continued.*

Formula of Substance to be estimated.	Weight, in mgms., of Substance ≡ 1 cm.³ $\frac{N}{10}$ Solution.	Logarithm.
Calcium—		
CaO,	2·805	0·4479329
$Ca(OH)_2$,	3·7058	0·5688820
$CaO_2 + 8H_2O$,	10·8114	1·0338819
$Ca_3(PO_4)_2$,	5·1716	0·7136305
$Ca_2H_2(PO_4)_2 + 4H_2O$,	5·738	0·7587605
$CaH_4(PO_4)_2 + H_2O$,	4·2024$\dot{6}$	0·6235042
$CaSO_4$,	6·808	0·8330195
$CaSO_4 + 2H_2O$,	8·6096	0·9349829
$CaSO_3$,	6·008	0·7787299
$CaSO_3 + 2H_2O$,	7·8096	0·8926288
CaS,	3·608	0·5572665
CaC_2O_4,	6·405	0·8065191
$Ca(C_2H_3O_2)_2$,	7·9074	0·8980337
$Ca(C_2H_3O_2)_2 + H_2O$,	8·8082	0·9448872
$Ca(CNS)_2$,	7·815	0·8929290
Cerium—		
$Ce^{\cdot\cdot\cdot}$,	4·675	0·6697816
$Ce_2(CO_3)_3$,	6·675	0·8244512
$CeCl_3$,	8·22	0·9148718
CeF_3,	6·575	0·8178957
Ce_2O_3,	5·475	0·7383841
$CePO_4$,	7·841$\dot{6}$	0·8944083
$Ce_2(SO_4)_3$,	9·478	0·9767167
$Ce_2(SO_4)_3 + 9H_2O$,	10·979$\dot{3}$	1·0405759
$Ce_2(C_2O_4)_3$,	9·075	0·9578466
$Ce_2(C_2O_4)_3 + 9H_2O$,	11·7774	1·0710494
$Ce(NO_3)_3$,	10·879	1·0365889
$Ce(NO_3)_3 + 6H_2O$,	14·4822	1·1608345
$Ce^{\cdot\cdot\cdot\cdot}$,	3·50625	0·5448429
CeO_2,	4·30625	0·6340992
CeF_4,	5·40625	0·7328961
$CeF_4 + H_2O$,	5·85665	0·7676493
$Ce(SO_4)_2$,	8·30925	0·9195618
$Ce(SO_4)_2 + 4H_2O$,	10·11075	1·0047834
$Ce(SO_4)_2 + 7H_2O$,	11·46205	1·0592623
Chlorine—		
Cl',	3·545	0·5496162
HCl,	3·6458	0·5617928
Cl_2O,	4·345	0·6379898
$HClO$,	5·2458	0·7198117
Cl_2O_3,	5·945	0·7741519
$HClO_2$,	6·8458	0·8354242
ClO_2,	6·745	0·8289820

TABLE LXXVB (1).—*continued.*

Formula of Substance to be estimated.	Weight, in mgms., of Substance ≡ 1 cm.^{3} $\frac{N}{10}$ Solution.	Logarithm.
Chlorine—		
Cl_2O_5,	7·545	0·8776592
$HClO_3$,	8·4458	0·9266408
Cl_2O_7,	9·145	0·9611837
$HClO_4$,	10·0458	1·0019845
Chromium—		
$Cr^{\cdots}$,	1·736$\dot{6}$	0·2397164
„ (in chromates),	2·605	0·4158077
$CrCl_3$,	5·281$\dot{6}$	0·7227709
Cr_2O_3,	2·536$\dot{6}$	0·4042634
$Cr(NO_3)_3 + 9H_2O$,	13·3454$\dot{6}$	1·1253337
$CrPO_4$,	4·903$\dot{3}$	0·6904914
$CrPO_4 + 6H_2O$,	8·5065$\dot{3}$	0·9297526
$Cr_2(SO_4)_3$,	6·539$\dot{6}$	0·8155556
$Cr_2(SO_4)_3 + 18H_2O$,	11·9444$\dot{6}$	1·0771667
$K_2Cr_2(SO_4)_4 + 24H_2O$,	16·6520$\dot{6}$	1·2214681
$(NH_4)_2Cr_2(SO_4)_4 + 24H_2O$,	15·9494$\dot{6}$	1·2027461
$Cr(CNS)_3$,	7·546$\dot{6}$	0·8777551
Cobalt—		
$Co^{\cdot\cdot}$,	2·95	0·4698220
$CoCO_3$,	5·95	0·7745170
$CoCl_2$,	6·495	0·8125792
$CoCl_2 + 6H_2O$,	11·8998	1·0755397
$Co(CN)_2$,	5·554	0·7446059
$Co(CN)_2 + 3H_2O$,	8 2564	0·9167907
$Co(NO_3)_2$,	9·154	0·9616109
$Co(NO_3)_2 + 6H_2O$,	14·5588	1·1631255
CoO,	3·75	0·5740313
$Co_3(AsO_4)_2$,	7·583$\dot{3}$	0·8798601
$Co_3(AsO_4)_2 + 8H_2O$,	9·9854$\dot{6}$	0·9993683
$Co_3(PO_4)_2$,	6·116$\dot{6}$	0·7865148
$Co_3(PO_4)_2 + 8H_2O$,	8·5188	0·9303784
$CoSO_4$,	7·753	0·8894698
$CoSO_4 + 7H_2O$,	14·0586	1·1479421
CoS,	4·553	0·6582976
$Co^{\cdots}$,	1·966$\dot{6}$	0·2937307
$CoCl_3$,	5·511$\dot{6}$	0·7412829
Co_2O_3,	2·766$\dot{6}$	0·4419568
Co_2S_3,	3·5696	0·5526276
Copper—		
$Cu^{\cdot}$,	6·36	0·8034571
Cu_2Br_2,	14·356	1·1570334
Cu_2Cl_2,	9·905	0·9958545
Cu_2F_2,	8·26	0·9169800

TABLE LXXVB (1).—*continued.*

Formula of Substance to be estimated.	Weight, in mgms., of Substance $\equiv$ 1 cm.^{3} $\frac{N}{10}$ Solution.	Logarithm.
Copper—		
Cu_2I_2,	19·045	1·2797810
Cu_2O,	7·16	0·8549130
$Cu_2SO_3 + H_2O$,	11·2638	1·0516849
Cu_2S,	7·963	0·9010767
$Cu_2(CNS)_2$,	12·17	1·0852906
$Cu^{\cdot\cdot}$,	3·18	0·5024271
$Cu(C_2H_3O_2)_2 + H_2O$,	9·983	0·9992611
$CuCO_3$,	6·18	0·7909885
$CuCl_2$,	6·725	0·8276923
$CuCl_2 + 2H_2O$,	8·5266	0·9307759
CuO,	3·98	0·5998831
$Cu(NO_3)_2$,	9·384	0·9723880
$Cu(NO_3)_2 + 3H_2O$,	12·0864	1·0822970
$Cu_3(PO_4)_2$,	6·346$\dot{6}$	0·8025456
$Cu_3(PO_4)_2 + 3H_2O$,	7·2474$\dot{6}$	0·8601862
$Cu_3(AsO_4)_2$,	7·813$\dot{3}$	0·8928363
$Cu_3(AsO_4)_2 + 2H_2O$,	8·4138$\dot{6}$	0·9249956
$CuHAsO_3$,	9·3804	0·9722214
$CuSO_4$,	7·983	0·9021661
$CuSO_4 + 5H_2O$,	12·487	1·0964581
CuS,	4·783	0·6797004
Fluorine—		
F',	1·9	0·2787536
HF,	2·0008	0·3012037
Gallium—		
$Ga^{\cdot\cdot}$,	3·5	0·5440680
$GaCl_2$,	7·045	0·8478810
$Ga^{\cdot\cdot\cdot}$,	2·333$\dot{3}$	0·3679767
$GaCl_3$,	5·878$\dot{3}$	0·7692542
Ga_2O_3,	3·133$\dot{3}$	0·4960065
$Ga(NO_3)_3$,	8·537$\dot{3}$	0·9313222
$Ga_2(SO_4)_3$,	7·136$\dot{3}$	0·8534751
$(NH_4)_2Ga_2(SO_4)_4 + 24H_2O$,	16·5461$\dot{3}$	1·2186964
Germanium—		
$Ge^{\cdot\cdot\cdot\cdot}$,	1·8125	0·2582780
$GeBr_4$,	9·8085	0·9916026
$GeCl_4$,	5·3575	0·7289622
GeF_4,	3·7125	0·5696665
$GeF_4 + 3H_2O$,	5·0637	0·7044679
H_2GeF_6,	4·7129	0·6732882
K_2GeF_6,	6·62	0·8208580
GeI_4,	14·4975	1·1612931
GeO_2,	2·6125	0·4170563

TABLE LXXVB (1).—*continued.*

Formula of Substance to be estimated.	Weight, in mgms., of Substance $\equiv$ 1 cm.^{3} $\frac{N}{10}$ Solution.	Logarithm.
Germanium—		
GeS_2,	3·4155	0·5334543
Gold—		
$Au^{\cdot}$,	19·72	1·2949069
$AuBr$,	27·716	1·4427306
$AuCl$,	23·265	1·3667031
$AuCN$,	22·324	1·3487720
$KAu(CN)_2$,	28·843	1·4600404
Au_2O,	20·52	1·3121774
$Au^{\cdot\cdot\cdot}$,	6·573$\dot{3}$	0·8177856
$AuCl_3$,	10·118$\dot{3}$	1·0051089
$AuCl_3 + 2H_2O$,	11·3194	1·0538234
$HAuCl_4$,	11·3336	1·0543678
$HAuCl_4 + 4H_2O$,	13·7357$\dot{3}$	1·1378518
$KAuCl_4$,	12·605	1·1005428
$KAuCl_4 + 2H_2O$,	13·8060$\dot{6}$	1·1400699
$KAu(CN)_4 + 6H_2O$,	14·9535$\dot{3}$	1·1747438
$2KAu(CN)_4 + 3H_2O$,	12·2511$\dot{3}$	1·0881762
$KAuO_2 + 3H_2O$,	10·7532$\dot{6}$	1·0315404
Indium—		
$In^{\cdot\cdot\cdot}$,	3·8	0·5797836
$InCl_3$,	7·345	0·8659918
In_2O_3,	4·6	0·6627578
$In_2(NO_3)_6 + 3H_2O$,	10·9048	1·0376177
$In_2(SO_4)_3$,	8·603	0·9346499
$In_2(SO_4)_3 + 4H_2O$,	9·8040$\dot{6}$	0·9914062
$(NH_4)_2In_2(SO_4)_4 + 24H_2O$,	18·0128	1·2555812
In_2S_3,	5·403	0·7326349
Iodine—		
I',	12·685	1·1032905
HI,	12·7858	1·1067279
KI,	16·6	1·2201081
HIO_3,	17·5858	1·2451622
KIO_3,	21·4	1·3304138
HIO_4,	19·1858	1·2829799
KIO_4,	23	1·3617278
H_3IO_5, Estimation of I,	20·9874	1·3219587
H_5IO_6,	22·789	1·3577253
$H_4I_2O_9$,	20·0866	1·3029065
I_2O_5,	16·685	1·2223262
Iridium—		
$Ir^{\cdot\cdot\cdot}$,	6·433$\dot{3}$	0·8084360
$IrBr_3$,	14·429$\dot{3}$	1·1592462
$IrBr_3 + 4H_2O$,	16·8314$\dot{6}$	1·2261219

TABLE LXXVB (1).—*continued.*

Formula of Substance to be estimated.	Weight, in mgms., of Substance ≡ 1 cm.^{3} $\frac{N}{10}$ Solution.	Logarithm.
Iridium—		
$K_3IrBr_6 + 3H_2O$, (Estimation of Br)	14·0709$\dot{6}$	1·1483239
$(NH_4)_3IrBr_6 + 3H_2O$, (Estimation of Br)	13·0170$\dot{6}$	1·1145131
$IrCl_3$, ...	9·978$\dot{3}$	0·9990580
$K_3IrCl_6 + 3H_2O$, (Estimation of Cl)	9·6199$\dot{6}$	0·9831735
$Na_3IrCl_6 + 12H_2O$, (Estimation of Cl)	11·5173$\dot{6}$	1·0613532
$(NH_4)_6Ir_2Cl_{12} + 3H_2O$, (Estimation of Cl)	8·115$\dot{6}$	1·9093242
$H_3Ir(NO_2)_6 + H_2O$, (Estimation of NO_2)	8·171$\dot{3}$	0·9122929
$K_3Ir(NO_2)_6 + H_2O$, (Estimation of NO_2)	10·0784$\dot{3}$	1·0033930
$H_3Ir(CN)_6$, (Estimation of CN)	5·8710$\dot{6}$	0·7687170
$K_3Ir(CN)_6$, (Estimation of CN)	7·7781$\dot{6}$	0·8908772
$Ba_3Ir_2(CN)_{12} + 18H_2O$, (Estimation of CN)	11·9580$\dot{6}$	1·0776610
Ir_2S_3, ...	8·036$\dot{3}$	0·9050579
$Ir^{\cdot\cdot\cdot\cdot}$, ...	4·825	0·6834973
$IrBr_4$, ...	12·821	1·1079219
H_2IrBr_6, (Estimation of Br)	11·2462$\dot{6}$	1·0510085
K_2IrBr_6, (Estimation of Br)	12·517$\dot{6}$	1·0975233
$IrCl_4$, ...	8·37	0·9227254
H_2IrCl_6, (Estimation of Cl)	6·7952$\dot{6}$	0·8322065
K_2IrCl_6, (Estimation of Cl)	8·066$\dot{6}$	0·9066941
Na_2IrCl_6, (Estimation of Cl)	7·53	0·8767949
$(NH_4)_2IrCl_6$, (Estimation of Cl)	7·3640$\dot{6}$	0·8671277
IrI_4, ...	17·51	1·2432861
IrS_2, ...	6·428	0·8080759
Iron (Ferrous compounds, Fe estimated as dyadic)—		
$Fe^{\cdot\cdot}$, ...	2·795	0·4463818
$FeBr_2$, ...	10·791	1·0330617
$FeBr_2 + 6H_2O$, ...	16·1958	1·2094024
$FeCO_3$, ...	5·795	0·7630534
$FeCl_2$, ...	6·34	0·8020893
$FeCl_2 + 4H_2O$, ...	9·9432	0·9975262
$K_4Fe(CN)_6$, ...	18·437	1·2656903
$Na_4Fe(CN)_6 + 12H_2O$, ...	26·0266	1·4154175
FeF_2, ...	4·695	0·6716356
$FeF_2 + 8H_2O$, ...	11·9014	1·0755981
FeI_2, ...	15·48	1·1897710
$Fe(NO_3)_2$, ...	8·999	0·9541942
$Fe(NO_3)_2 + 6H_2O$, ...	14·4038	1·1584771
FeO, ...	3·595	0·5556989
$Fe(ClO_4)_2 + 6H_2O$, ...	18·1448	1·2587522
$Fe_3(PO_4)_2$, ...	5·961$\dot{6}$	0·7753676
$Fe_3(PO_4)_2 + 8H_2O$, ...	8·3638	0·9224036
$FeHPO_4 + H_2O$, ...	8·4962	0·9292247

TABLE LXXVB (1).—*continued.*

Formula of Substance to be estimated.	Weight, in mgms., of Substance $\equiv$ 1 cm.^{3} $\frac{N}{10}$ Solution.	Logarithm.
Iron { (Ferrous compounds, Fe estimated as dyadic)—		
$FeSO_4$,	7·598	0·8806993
$FeSO_4 + 7H_2O$,	13·9036	1·1431272
$Fe(NH_4)_2(SO_4)_2 + 6H_2O$,	19·613	1·2925440
FeS_2O_7,	11·601	1·0644954
FeS,	4·398	0·6432552
$FeSO_3$,	6·798	0·8323812
FeS_2O_3,	8·401	0·9243310
$Fe(C_2H_3O_2)_2 + 4H_2O$,	12·3006	1·0899263
$FeC_2O_4 + 2H_2O$,	8·9966	0·9540784
$Fe(NH_4)_2(C_2O_4)_2 + 3H_2O$,	16·1046	1·2069499
$FeK_2(C_2O_4)_2 + 2H_2O$,	17·3116	1·2383372
$FeC_4H_4O_6$,	10·1966	1·0084554
Iron { (Ferric compounds, Fe estimated as triadic)—		
$Fe^{\cdots}$,	1·863$\dot{3}$	0·2702905
Fe_2Br_6,	9·859$\dot{3}$	0·9938475
Fe_2Cl_6,	5·408$\dot{3}$	0·7330634
$Fe_2Cl_6 + 6H_2O$,	7·2099$\dot{3}$	0·8579312
$Fe_2Cl_6 + 12H_2O$,	9·0115$\dot{3}$	0·9547986
$K_4Fe_2Cl_{10} + 2H_2O$,	10·9822	1·0406893
$(NH_4)_2Fe_2Cl_{10} + 2H_2O$,	9·577	0·9812294
Fe_2F_6,	3·763$\dot{3}$	0·5755726
$Fe_2F_6 + 9H_2O$,	6·4657$\dot{3}$	0·8106178
$Fe_2(NO_3)_6$,	8·667$\dot{3}$	0·9067300
$Fe_2(NO_3)_6 + 12H_2O$,	11·6705$\dot{3}$	1·0670906
$Fe_2(NO_3)_6 + 18H_2O$,	13·4721$\dot{3}$	1·1294363
Fe_2O_3,	2·663$\dot{3}$	0·4254255
$Fe_2(PO_4)_2$,	5·03	0·7015679
$Fe_2(PO_4)_2 + 4H_2O$,	6·2310$\dot{6}$	0·7945623
$Fe_2(AsO_4)_2 + 4H_2O$,	7·6977$\dot{3}$	0·8863629
$Fe_2(SO_4)_3$,	6·666$\dot{3}$	0·8238870
$Fe_2(SO_4)_3 + 9H_2O$,	9·3687$\dot{3}$	0·9716808
$K_2Fe_2(SO_4)_4 + 24H_2O$,	16·7787$\dot{3}$	1·2247591
$(NH_4)_2Fe_2(SO_4)_4 + 24H_2O$,	16·0761$\dot{3}$	1·2061816
$H_6Fe_2(CN)_{12}$,	7·1721$\dot{3}$	0·8556483
$K_6Fe_2(CN)_{12}$,	10·986$\dot{3}$	1·0408527
$Fe_2(CNS)_6 + 3H_2O$,	8·5741$\dot{3}$	0·9331902
$Fe_2(C_2H_3O_2)_6 + 4H_2O$,	8·9668	0·9526374
$Fe_2(C_2H_3O_2)_4(NO_3)_2 + 6H_2O$,	9·6678$\dot{6}$	0·9853306
$Fe_2(C_2O_4)_3$,	6·263$\dot{3}$	0·7968055
$Fe_2(C_4H_4O_6)_3$,	9·2649$\dot{3}$	0·9668423

TABLE LXXVB (1).—*continued.*

Formula of Substance to be estimated.	Weight, in mgms., of Substance ≡ 1 cm.^{3} $\frac{N}{10}$ Solution.	Logarithm.
Iron { (In ferroso-ferric compounds, from Negative Radicle estimations)—		
Fe,	2·09625	0·3214431
Fe_3Cl_8,	5·64125	0·7513753
$Fe_3Cl_8 + 18H_2O$,	9·69485	0·9865411
Fe_3O_4,	2·89625	0·4618360
$Fe_3(SO_4)_4$,	6·89925	0·8388019
$Fe_3(SO_4)_4 + 12H_2O$,	9·60165	0·9823458
See also LXXVB. (2)		
Lanthanum—		
$La^{\cdots}$,	4·63	0·6655809
$La_2(CO_3)_3$,	7·63	0·8825245
$La_2(CO_3)_3 + 8H_2O$,	10·0321$\dot{3}$	1·0013933
$LaCl_3$,	8·175	0·9124877
$LaCl_3 + 7H_2O$,	12·3787$\dot{3}$	1·0926761
$La(NO_3)_3$,	10·834	1·0347888
$La(NO_3)_3 + 6H_2O$,	14·4732	1·1594829
La_2O_3,	5·43	0·7347998
$La_2(SO_4)_3$,	9·433	0·9746498
$La_2(SO_4)_3 + 9H_2O$,	12·1354	1·0840541
La_2S_3,	6·233	0·7946971
$La_2(C_2O_4)_3$,	9·03	0·9556877
$La_2(C_2O_4)_3 + 9H_2O$,	11·7324	1·0693868
Lead (Dyadic throughout)—		
$Pb^{\cdot\cdot}$,	10·345	1·0147305
$PbBr_2$,	18·341	1·2634230
$PbCO_3$,	13·345	1·1253186
$Pb_3H_2(CO_4)_2$	12·9119$\dot{3}$	1·1109913
$PbCl_2$,	13·89	1·1427022
PbF_2,	12·245	1·0879588
PbI_2,	23·03	1·3622939
$Pb(NO_3)_2$,	16·549	1·2187718
$Pb(NO_2)_2$,	14·949	1·1746121
PbO,	11·145	1·0470801
Pb_2O_3,	11·545	1·0623939
Pb_3O_4,	11·411$\dot{6}$	1·0573490
PbO_2,	11·945	1·0771861
$PbSO_4$,	15·148	1·1803553
Pb_2SO_5,	13·1465	1·1188101
PbS,	11·948	1·0772952
Lithium—		
$Li^{\cdot}$,	0·703	$\bar{1}$·8469553
$LiBr$,	8·699	0·9394693
Li_2CO_3,	3·703	0·5685537

TABLE LXXVB (1).—*continued.*

Formula of Substance to be estimated.	Weight, in mgms., of Substance ≡ 1 cm.^{3} $\frac{N}{10}$ Solution.	Logarithm.
Lithium—		
$LiCl$,	4·248	0·6281845
$LiCl + H_2O$,	6·0496	0·7817267
$LiCl + 2H_2O$,	7·8512	0·8949360
$LiNO_3$,	6·907	0·8392895
Li_2O,	1·503	0·1769590
Li_3PO_4,	3·869$\dot{6}$	0·5876735
Li_2SO_4,	5·506	0·7408362
$Li_2SO_4 + H_2O$,	6·4068	0·8066411
Magnesium—		
$Mg^{\cdot\cdot}$,	1·218	0·0856473
$MgBr_2$,	9·214	0·9644482
$MgBr_2 + 6H_2O$,	14·6188	1·1649117
$MgCO_3$,	4·218	0·6251066
$Mg_4(HO)_2(CO_3)_3 + 3H_2O$,	4·5688	0·6598022
$MgCl_2$,	4·763	0·6778806
$MgCl_2 + 6H_2O$,	10·1678	1·0072270
MgF_2,	3·118	0·4938761
MgI_2,	13·903	1·1431085
$Mg(NO_3)_2$,	7·422	0·8705209
MgO,	2·018	0·3049212
$Mg(OH)_2$,	2·9188	0·4652043
$Mg_3(PO_4)_2$,	4·384$\dot{6}$	0·6419365
$MgNH_4PO_4 + 6H_2O$,	12·2764	1·0890711
$Mg_2P_2O_7$,	5·568	0·7456992
$Mg_2As_2O_7$,	7·768	0·8903092
$MgSO_4$,	6·021	0·7796686
$MgSO_4 + H_2O$,	6·9218	0·8402190
$MgSO_4 + 7H_2O$,	12·3266	1·0908433
Manganese—		
$Mn^{\cdot\cdot}$,	2·75	0·4393327
$MnBr_2$,	10·746	1·0312468
$MnBr_2 + 4H_2O$,	14·3492	1·1568277
$MnCO_3$,	5·75	0·7596678
$MnCl_2$,	6·295	0·7989957
$MnCl_2 + 4H_2O$,	9·8982	0·9955562
MnF_2,	4·65	0·6674529
MnI_2,	15·435	1·1885066
$MnI_2 + 4H_2O$,	19·0382	1·2796259
$Mn(NO_3)_2$,	8·954	0·9520171
$Mn(NO_3)_2 + 6H_2O$,	14·3588	1·1571182
MnO,	3·55	0·5502283
Mn_3O_4,	3·816$\dot{6}$	0·5816842
Mn_2O_3,	3·95	0·5965971

TABLE LXXVB (1).—*continued.*

Formula of Substance to be estimated.	Weight, in mgms., of Substance ≡ 1 cm.^{3} $\frac{N}{10}$ Solution.	Logarithm.
Manganese—		
MnO_2,	4·35	0·6384893
Mn_2O_7,	5·55	0·7442930
$Mn_3(PO_4)_2$,	5·916$\dot{6}$	0·7720771
$Mn_3(PO_4)_2+7H_2O$,	8·0185$\dot{3}$	0·9040949
$MnHPO_4+3H_2O$,	10·2528	1·0108425
$MnH_4(PO_4)_2+2H_2O$,	14·2532	1·1539123
$Mn_2P_2O_7$,	7·1	0·8512583
$MnHAsO_4$,	9·7504	0·9890224
$MnH_4(AsO_4)_2$,	16·8516	1·2266412
$MnSO_4$,	7·553	0·8781195
$MnSO_4+4H_2O$,	11·1562	1·0475163
$MnSO_4+5H_2O$,	12·057	1·0812393
$MnSO_4+7H_2O$,	13·8586	1·1417194
$MnAl_2(SO_4)_4+24H_2O$,	46·2912	1·6654984
MnS,	4·353	0·6387887
$MnS_2O_6+3H_2O$,	13·4584	1·1289935
Mercury—		
$Hg^{\cdot}$,	20	1·3010300
$HgBr$,	27·996	1·4470960
$HgCl$,	23·545	1·3718987
HgF,	21·9	1·3404441
HgI,	32·685	1·5143485
$HgNO_3$,	26·204	1·4183676
$HgNO_3+H_2O$,	28·0016	1·4471828
Hg_2O,	20·8	1·3180633
$Hg^{\cdot\cdot}$,	10	1·0000000
$HgBr_2$,	17·996	1·2551760
$HgCl_2$,	13·545	1·1317790
HgF_2+2H_2O,	13·7016	1·1367713
HgI_2,	22·685	1·3557388
$Hg(NO_3)_2$,	16·204	1·2096222
HgO,	10·8	1·0334238
$HgSO_4$,	14·803	1·1703497
Hg_3SO_6,	12·134$\dot{3}$	1·0840159
$Hg(CN)_2$,	12·604	1·1005084
HgS,	11·603	1·0645703
Molybdenum—		
$Mo^{\cdot\cdot}$, } In ccs. corresponding to the monoxide,	4·8	0·6812412
$MoBr_2$, } In ccs. corresponding to the monoxide,	12·796	1·1070742
$MoCl_2$, } In ccs. corresponding to the monoxide,	8·345	0·9214263
MoO, } In ccs. corresponding to the monoxide,	5·6	0·7481880

TABLE LXXVB (1).—*continued.*

Formula of Substance to be estimated.	Weight, in mgms., of Substance $\equiv$ 1 cm.^{3} $\frac{N}{10}$ Solution.	Logarithm.
Molybdenum—		
$Mo^{\cdot\cdot\cdot}$, In cos. corresponding to the sesquioxide,	3·2	0·5051499
Mo_2Br_6,	11·196	1·0490628
Mo_2Cl_6,	6·745	0·8289819
Mo_2O_3,	4·0	0·6020599
$Mo^{\cdot\cdot\cdot\cdot}$, In cos. corresponding to the dioxide,	2·4	0·3802112
$MoBr_4$,	10·396	1·0168663
$MoCl_4$,	5·945	0·7741519
MoI_4,	15·085	1·1785453
MoO_2,	3·2	0·5051500
$Mo(OH)_4$,	4·1008	0·6128686
$Mo^{\cdot\cdot\cdot\cdot\cdot}$, In penta-compounds,	1·92	0·2833012
$MoCl_5$,	5·465	0·7375902
Nickel—		
$Ni^{\cdot\cdot}$,	2·935	0·4676081
$NiBr_2$,	10·931	1·0386599
$NiBr_2 + 3H_2O$,	13·6324	1·1345723
$NiCO_3$,	5·935	0·7734207
$NiCl_2$,	6·48	0·8115750
$NiCl_2 + 6H_2O$,	11·8848	1·0749919
NiF_2,	4·835	0·6843965
$NiF_2 + 3H_2O$,	7·5374	0·8772215
NiI_2,	15·62	1·1936810
$NiI_2 + 6H_2O$,	21·0248	1·3227319
$Ni(NO_3)_2$,	9·139	0·9608987
$Ni(NO_3)_2 + 6H_2O$,	14·5438	1·1626779
NiO,	3·735	0·5722906
$Ni_3(PO_4)_2$,	6·101$\dot{6}$	0·7854484
$Ni_3(AsO_4)_2$,	7·568$\dot{3}$	0·8790002
$NiSO_4$,	7·738	0·8886287
$NiSO_4 + 7H_2O$,	14·0436	1·1474785
NiS,	4·538	0·6568645
$Ni(CN)_2$,	5·539	0·7434314
Niobium—		
$Nb^{\cdot\cdot\cdot}$, In tri-compounds,	3·133$\dot{3}$	0·4960066
$NbCl_3$,	6·678$\dot{3}$	0·8246680
$Nb^{\cdot\cdot\cdot\cdot\cdot}$,	1·88	0·2741579
$NbBr_5$,	9·876	0·9945811
$NbCl_5$,	5·425	0·7343997
NbF_5,	3·78	0·5774918
Nb_2O_5,	2·68	0·4281348

TABLE LXXVB (1).—*continued.*

Formula of Substance to be estimated.	Weight, in mgms., of Substance $\equiv$ 1 cm.^{3} $\frac{N}{10}$ Solution.	Logarithm.
Nitrogen—		
All the nitrogen being converted into NH_3 before titration:		
$N^{\cdots}$,	1·404	0·1473671
N_2O,	2·204	0·3432116
NO,	3·004	0·4776999
N_2O_3,	3·804	0·5802405
NO_2,	4·604	0·6631353
N_2O_5,	5·404	0·7327153
HNO,	3·1048	0·4920336
HNO_2,	4·7048	0·6725412
HNO_3,	6·3048	0·7996713
NH_3,	1·7064	0·2320808
NH_4Br,	9·8032	0·9913679
$(NH_4)_2CO_3$,	4·8072	0·6818922
$(NH_4)_2CO_3 + H_2O$,	5·708	0·7564840
HNH_4CO_3,	7·908	0·8980667
$NH_4CO_2NH_2$,	3·9064	0·5917767
NH_4Cl,	5·3522	0·7285323
NH_4ClO_3,	10·1522	1·0065602
NH_4F,	3·7072	0·5690460
HNH_4F_2,	5·708	0·7564840
NH_4I,	14·4922	1·1611343
NH_4NO_3,	4·0056	0·6026676
NH_3 (distilled off):		
NH_4NO_3,	8·0112	0·9036976
$(NH_4)_3PO_4$,	4·97386	0·6966941
$H(NH_4)_2PO_4$,	6·6076	0·8200438
$H_2NH_4PO_4$,	11·5088	1·0610301
NH_4NaHPO_4,	13·713	1·1371325
$(NH_4)_2SO_4$,	6·6102	0·8202146
Calculated from the NH_4:		
NH_4CN,	4·4112	0·6445567
NH_4CNO,	6·0112	0·7789612
NH_4CNS,	7·6172	0·8817954
Total N titrated as NH_3:		
NH_4CN,	2·2056	0·3435267
NH_4CNO,	3·0056	0·4779312
NH_4CNS,	3·8086	0·5807654
Osmium—		
In cos. corresponding to the monoxide:		
$Os^{\cdot\cdot}$,	9·55	0·9800034
OsO,	10·35	1·0149403
$OsSO_3$,	4·775	0·6789734
In cos. corresponding to the dioxide:		
$Os^{\cdot\cdot\cdot\cdot}$,	8·32	0·9201233
$OsCl_4$,	5·575	0·7462449
OsO_2,	6·4758	0·8112934
$Os(OH)_4$,	13·553	1·1320354

TABLE LXXVB (1).—*continued.*

Formula of Substance to be estimated.	Weight, in mgms., of Substance $\equiv$ 1 cm.^{3} $\frac{N}{10}$ Solution.	Logarithm.
Palladium—		
$Pd^{\cdot\cdot}$, (In -ous compounds)	5·325	0·7263196
$PdCl_2$, (In -ous compounds)	8·87	0·9479236
K_2PdCl_4, (In -ous compounds)	16·33	1·2129862
PdI_2, (In -ous compounds)	18·01	1·2555137
$Pd(NO_3)_2$, (In -ous compounds)	11·529	1·0617916
PdO, (In -ous compounds)	6·125	0·7871061
$PdCN$, (In -ous compounds)	7·929	0·8992184
$PdSO_4+H_2O$, (In -ous compounds)	11·0288	1·0425282
$Pd^{\cdot\cdot\cdot\cdot}$, (Pd reckoned as a tetrad)	2·6625	0·4252896
$PdCl_4$, (Pd reckoned as a tetrad)	6·2075	0·7929167
H_2PdCl_6, (Pd reckoned as a tetrad)	8·0304	0·9047372
K_2PdCl_6, (Pd reckoned as a tetrad)	9·9375	0·9972771
$(NH_4)_2PdCl_6$, (Pd reckoned as a tetrad)	8·8836	0·9485890
Phosphorus (estimated as phosphate)—		
P,	$1{\cdot}03\dot{3}$	0·0142404
PBr_3,	$9{\cdot}029\dot{3}$	0·9556556
PBr_5,	14·36	1·1571544
PCl_3,	$4{\cdot}578\dot{3}$	0·6607074
PCl_5,	$6{\cdot}941\dot{6}$	0·8414637
PF_5,	4·2	0·6232492
PI_2,	9·49	0·9772662
PI_3,	$13{\cdot}718\dot{3}$	1·1373013
HPH_2O_2,	2·2008	0·3425805
$Ba(PH_2O_2)_2$,	4·4572	0·6490621
$Ca(PH_2O_2)_2$,	$2{\cdot}8355\dot{3}$	0·4526347
P_2O_3,	$1{\cdot}833\dot{3}$	0·2632414
H_3PO_3,	$2{\cdot}7341\dot{3}$	0·4368196
Na_3PO_3,	$4{\cdot}938\dot{3}$	0·6024507
$CaHPO_3$,	4·0036	0·3741370
P_2O_5,	$2{\cdot}366\dot{6}$	0·5142111
H_3PO_4,	$3{\cdot}2674\dot{6}$	0·4723468
$H_4P_2O_7$,	2·9672	0·4260121
HPO_3,	$2{\cdot}6669\dot{3}$	0·7136305
$Ca_3(PO_4)_2$,	$5{\cdot}171\dot{6}$	0·6935804
$Ca_2H_2(PO_4)_2$,	$4{\cdot}5369\dot{3}$	0·6567623
$CaH_4(PO_4)_2$,	3·9022	0·5913095
$Mg_2P_2O_7$,	3·712	0·5696079
$(UO_2)_2P_2O_7$,	$11{\cdot}916\dot{6}$	1·0761547
$FePO_4$,	5·03	0·7015679
$Pb_3(PO_4)_2$,	$13{\cdot}511\dot{6}$	1·1307089
$Mg_3(PO_4)_2$,	$4{\cdot}384\dot{6}$	0·6419365
Ag_3PO_4,	$13{\cdot}959\dot{6}$	1·1448750

TABLE LXXVB (1).—*continued.*

Formula of Substance to be estimated.	Weight, in mgms., of Substance ≡ 1 cm.³ $\frac{N}{10}$ Solution.	Logarithm.
Phosphorus (estimated as phosphate)—		
$Ag_4P_2O_7$,	10·095$\dot{3}$	1·0041206
Na_3PO_4,	5·471$\dot{6}$	0·7381196
$Na_3PO_4 + 12H_2O$,	12·6780$\dot{6}$	1·1030530
$Na_2HPO_4 + 12H_2O$,	11·943$\dot{3}$	1·0771255
$NaH_2PO_4 + H_2O$,	4·6027$\dot{3}$	0·6630160
Platinum (estimated as dyad)—		
$Pt^{\cdot\cdot}$,	9·74	0·9885590
$PtBr_2$,	17·736	1·2488557
K_2PtBr_4,	29·647	1·4719807
$PtCl_2$,	13·285	1·1233616
K_2PtCl_4,	20·745	1·3169134
$(NH_4)_2PtCl_4$,	18·6372	1·2703807
PtI_2,	22·425	1·3507324
$K_2Pt(NO_2)_4$,	22·863	1·3591332
$K_2Pt(NO_2)_4 + 2H_2O$,	24·6646	1·3920741
$(NH_4)_2Pt(NO_2)_4 + 2H_2O$,	22·5568	1·3532775
$Ag_2Pt(NO_2)_4$,	29·741	1·4733556
$BaPt(NO_2)_4 + 3H_2O$,	28·5204	1·4551556
PtO,	10·54	1·0228406
$K_6Pt(SO_3)_4 + 2H_2O$,	39·2986	1·5943771
$(NH_4)_6Pt(SO_3)_4$,	31·1736	1·4937870
PtS,	11·343	1·0547279
$H_2Pt(CN)_4 + 5H_2O$,	19·5528	1·2912090
$K_2Pt(CN)_4 + 12H_2O$,	29·6726	1·4723556
$BaPt(CN)_4 + 4H_2O$,	25·4212	1·4051960
$K_2Pt(CNS)_4$,	25·275	1·4026912
$Pt^{\cdot\cdot\cdot\cdot}$ (estimated as tetrad),	4·87	0·6875290
$H_2PtBr_6 + 9H_2O$,	20·968	1·3215570
$PtCl_4$,	8·415	0·9250541
$PtCl_4 + 5H_2O$,	10·667	1·0280423
$H_2PtCl_6 + 6H_2O$,	12·9403	1·1119444
K_2PtCl_6,	12·145	1·0843975
$(NH_4)_2PtCl_6$,	11·0911	1·0449746
Rb_2PtCl_6,	14·4575	1·1600932
Cs_2PtCl_6,	16·8375	1·2262776
PtI_4,	17·555	1·2444008
PtO_2,	5·67	0·7535831
$Pt(SO_4)_2$,	9·673	0·9855612
$K_2Pt(CNS)_6$,	15·5425	1·1915209
Potassium—		
$K^{\cdot}$,	3·915	0·5927318
KBr,	11·911	1·0759482
K_2CO_3,	6·915	0·8397922

TABLE LXXVB (1).—*continued.*

Formula of Substance to be estimated.	Weight, in mgms., of Substance $\equiv$ 1 cm.^{3} $\frac{N}{10}$ Solution.	Logarithm.
Potassium—		
$K_2CO_3 + 2H_2O$,	8·7166	0·9403471
$KHCO_3$,	10·0158	1·0006856
KCl,	7·46	0·8727388
$KClO$,	9·06	0·9571282
$KClO_3$,	12·26	1·0884905
$KClO_4$,	13·86	1·1417632
KF,	5·815	0·7645497
KHF_2, estimation of F,	3·9079	0·5919434
KI,	16·6	1·2201081
KIO_3,	21·4	1·3304138
KIO_4,	23·0	1·3617278
$K_3IO_5 + 4H_2O$,	13·2121$\dot{3}$	1·1209729
$K_4I_2O_9 + 9H_2O$,	17·9111	1·2531222
KNO_3,	10·119	1·0051376
KNO_2,	8·519	0·9303886
K_2O,	4·715	0·6734817
KOH,	5·6158	0·7494116
$KMnO_4$,	15·815	1·1990692
K_3PO_4,	7·081$\dot{6}$	0·8501354
K_2HPO_4, Estimation of PO_4,	5·8102$\dot{6}$	0·7641960
KH_2PO_4,	4·5388$\dot{6}$	0·6579473
KPO_3,	11·815	1·0724337
$K_2P_2O_6 + H_2O$,	12·7158	1·1043437
$K_4P_2O_7$,	8·265	0·9172428
$K_4P_2O_7 + 3H_2O$,	9·6162	0·9830034
K_2HPO_3,	7·9154	0·8984728
KPH_2O_2,	10·4166	1·0177260
K_3AsO_4, Estimation of AsO_4,	8·548$\dot{3}$	0·9318814
KH_2AsO_4,	6·0055$\dot{3}$	0·7785516
K_2SiO_3,	7·735	0·8884603
$K_2Si_4O_9$,	16·795	1·2251800
K_2SiF_6,	11·035	1·0427723
K_2SO_4,	8·718	0·9404169
$KHSO_4$,	13·6218	1·1342345
$K_2S_2O_7$,	12·721	1·1045212
$K_2SO_3 + 2H_2O$,	9·7196	0·9876484
$KHSO_3$,	12·0218	1·0803306
$K_2S_2O_5$,	11·121	1·0461438
$K_2Al_2(SO_4)_4 + 24H_2O$,	47·4562	1·6762929
$K_2Cr_2(SO_4)_4 + 24H_2O$,	49·9562	1·6985894
$K_2Fe_2(SO_4)_4 + 24H_2O$,	50·3362	1·7018804
$K_2S_2O_3$,	9·521	0·9786826
$3K_2S_2O_3 + H_2O$,	9·8212$\dot{6}$	0·9921674

TABLE LXXVB (1).—*continued.*

Formula of Substance to be estimated.	Weight, in mgms., of Substance ≡ 1cm.³ $\frac{N}{10}$ Solution.	Logarithm.
Potassium—		
KCN,	6·519	0·8141810
$KAg(CN)_2$,	19·916	1·2992021
$K_4Fe(CN)_6$,	9·2185	0·9646603
$K_4Fe(CN)_6 + 3H_2O$,	10·5697	1·0240626
$K_3Fe(CN)_6$,	10·986$\dot{3}$	1·0408527
$KCNS$,	9·725	0·9878896
$KC_2H_3O_2$,	9·8174	0·9919965
$K_2C_2O_4 + H_2O$,	9·2158	0·9645331
$KHC_2O_4 + H_2O$,	14·6174	1·1648701
$K_2C_4H_4O_6$,	11·3166	1·0537159
$2K_2C_4H_4O_6 + H_2O$,	11·767	1·0706657
$KHC_4H_4O_6$,	18·819	1·2745965
Rhodium—		
In compounds where Rh is a dyad		
$Rh^{\cdot\cdot}$,	5·15	0·7118072
$RhCl_2$	8·695	0·9392696
RhO	5·95	0·7745170
In sesqui-compounds		
$Rh^{\cdot\cdot\cdot}$,	3·433$\dot{3}$	0·5357159
Rh_2Cl_6,	6·978$\dot{3}$	0·8437517
$K_4Rh_2Cl_{10} + 2H_2O$,	12·5522	1·0987198
Rh_2O_3,	4·233$\dot{3}$	0·6266824
$Rh_2(SO_4)_3 + 12H_2O$,	11·8395$\dot{3}$	1·0733345
$Rh_2(SO_3)_3 + 6H_2O$,	9·2379$\dot{3}$	0·9655748
$Rh_2(CN)_6$,	6·037$\dot{3}$	0·7808451
Rh_2S_3,	5·036$\dot{3}$	0·7021144
In tetrad compounds		
$Rh^{\cdot\cdot\cdot\cdot}$,	2·575	0·4107772
RhO_2	3·375	0·6282738
Rubidium—		
$Rb^{\cdot}$,	8·54	0·9314579
$RbBr$,	16·536	1·2184305
Rb_2CO_3,	11·54	1·0622058
$RbCl$,	12·085	1·0822467
Rb_2PtCl_6,	28·915	1·4611232
RbF,	10·44	1·0187005
RbI,	21·225	1·3268477
$RbNO_3$,	14·744	1·1686153
Rb_2O,	9·34	0·9703469
$RbOH$,	10·2408	1·0103339
Rb_2SO_4,	13·343	1·1252535
$Rb_2Al_2(SO_4)_4 + 24H_2O$,	52·0812	1·7166810

TABLE LXXVB (1).—*continued.*

Formula of Substance to be estimated.	Weight, in mgms., of Substance ≡ 1 cm.^{3} $\frac{N}{10}$ Solution.	Logarithm.
Ruthenium—		
In sesqui-compounds,		
$Ru^{\cdots}$,	3·39	0·5301997
Ru_2Cl_6,	6·935	0·8410464
$K_4Ru_2Cl_{10}$,	11·908$\dot{3}$	1·0758509
Ru_2I_6,	16·075	1·2061509
Ru_2O_3,	4·19	0·6222140
Ru_2S_3,	4·993	0·6983615
In -ic compounds,		
$Ru^{\cdots\cdot}$,	2·5425	0·4052610
$RuCl_4$,	6·0875	0·7844390
K_2RuCl_6,	9·8175	0·9920009
RuO_2,	3·3425	0·5240714
$Ru(OH)_4 + 3H_2O$,	5·5945	0·7477613
$Ru(SO_4)_2$,	7·3455	0·8660214
Scandium—		
$Sc^{\cdots}$,	1·47	0·1673173
Sc_2O_3,	2·27	0·3560258
$Sc_2(SO_4)_3$,	6·273	0·7974752
$Sc_2(SO_4)_3 + 6H_2O$,	8·0746	0·9071210
Selenium (calculated from Halogens)—		
$Se^{\cdot}$,	7·92	0·8987252
Se_2Br_2,	15·916	1·2018339
Se_2Cl_2,	11·465	1·0593741
Se_2I_2,	20·605	1·3139726
$Se^{\cdots\cdot}$,	1·98	0·2966652
$SeBr_4$,	9·976	0·9989564
$SeCl_4$,	5·525	0·7423323
SeI_4,	14·6625	1·1662080
Silicon (calculated from Halogens)—		
In tetra-compounds,		
$Si^{\cdots\cdot}$,	0·71	$\bar{1}$·8512583
$SiBr_4$,	8·706	0·9398187
$SiCl_4$,	4·255	0·6288996
SiF_4,	2·61	0·4166405
SiI_4,	13·395	1·1269427
In trihaloid compounds,		
$Si^{\cdots}$,	9·466$\dot{6}$	0·9761970
Si_2Br_6,	8·942$\dot{6}$	0·9514670
Si_2Cl_6,	4·491$\dot{6}$	0·6524075
$SiHCl_3$,	4·5252$\dot{6}$	0·6556441
$SiHI_3$,	13·6652$\dot{6}$	1·1356181
Si_2I_6,	13·631$\dot{6}$	1·1345489
Silver—		
$Ag^{\cdot}$,	10·793	1·0331422
$AgBr$,	18·789	1·2739037
Ag_2CO_3,	13·793	1·1396587
$AgCl$,	14·338	1·1564886

TABLE LXXVB (1).—*continued.*

Formula of Substance to be estimated.	Weight, in mgms., of Substance ≡ 1 cm.^{3} $\frac{N}{10}$ Solution.	Logarithm.
Silver—		
$AgClO_2$,	17·538	1·2439801
$AgClO_3$,	19·138	1·2818966
AgF,	12·693	1·1035643
$AgF + 2H_2O$,	14·4946	1·1612062
AgI,	23·478	1·3706611
$AgNO_3$,	16·997	1·2303723
$AgNO_2$,	15·397	1·1874361
$AgNO$,	13·797	1·1397847
Ag_2O,	11·593	1·0641958
Ag_3PO_4,	13·959$\dot{6}$	1·1448750
$Ag_4P_2O_7$,	15·14$\dot{3}$	1·1802119
Ag_3AsO_4,	15·426$\dot{3}$	1·1882627
Ag_3AsO_3,	14·893	1·1729821
Ag_2SO_4,	15·596	1·1930132
$AgHSO_4$,	20·4998	1·3117497
Ag_2SO_3,	14·796	1·1701443
$Ag_2S_2O_3$,	16·399	1·2148174
$AgNaS_2O_3$,	24·31	1·3857850
Ag_2S,	12·396	1·0932816
$AgCN$,	13·397	1·1270076
$AgK(CN)_2$,	19·916	1·2992021
$AgCNO$,	14·997	1·1760044
$AgCNS$,	16·603	1·2201866
Sodium—		
$Na^{\cdot}$,	2·305	0·3626709
$NaBr$,	10·301	1·0132587
$NaBr + 2H_2O$,	13·9042	1·1431460
Na_3BO_3,	4·271$\dot{6}$	0·6305973
$Na_2B_4O_7$,	10·105	1·0045363
$Na_2B_4O_7 + 10H_2O$,	19·113	1·2813289
Na_2CO_3,	5·305	0·7246854
$Na_2CO_3 + 10H_2O$,	14·313	1·1557307
$Na_2CO_3 + 7H_2O$,	11·6106	1·0648546
$Na_2CO_3 + H_2O$,	6·2058	0·7927978
$NaHCO_3$,	8·4058	0·9245791
$NaCl$,	5·85	0·7671559
$NaCl + 2H_2O$,	9·4532	0·9755788
$NaClO$,	7·45	0·8721563
$NaClO_3$,	10·65	1·0273496
$NaClO_4$,	12·25	1·0881361
Na_2CrO_4,	8·11	0·9090208
$Na_2CrO_4 + 10H_2O$,	17·118	1·2334530
$Na_2Cr_2O_7$,	13·115	1·1177683

TABLE LXXVB (1).—*continued.*

Formula of Substance to be estimated.	Weight, in mgms., of Substance ≡ 1 cm.^{3} $\frac{N}{10}$ Solution.	Logarithm.
Sodium—		
NaF,	4·205	0·6237660
NaI,	14·99	1·1758016
$NaI + 2H_2O$,	18·5932	1·2693542
$NaIO_3$,	19·79	1·2964458
$NaNO_3$,	8·509	0·9298785
$NaNO_2$,	6·909	0·8394152
Na_2O,	3·105	0·4920616
$NaOH$,	4·0058	0·6026893
Na_3PO_4, } Estimation of PO_4	5·471$\dot{6}$	0·7381196
$Na_3PO_4 + 12H_2O$, } Estimation of PO_4	12·6780$\dot{6}$	1·1030530
$Na_2HPO_4 + 12H_2O$, } Estimation of PO_4	11·943$\dot{3}$	1·0771255
$NaH_2PO_4 + H_2O$, } Estimation of PO_4	4·6027$\dot{3}$	0·6630158
$Na_4P_2O_7 + 10H_2O$, } Estimation of P_2O_7	11·159	1·0476253
$Na_2H_2P_2O_7$, } Estimation of P_2O_7	5·5529	0·7445199
$NaPO_3$,	10·205	1·0088130
$NaH_2PO_2 + H_2O$,	10·6082	1·0256417
Na_3AsO_4, } Estimation of AsO_4	6·938$\dot{3}$	0·8412551
$Na_2HAsO_4 + 12H_2O$, } Estimation of AsO_4	13·41	1·1274288
Na_2HAsO_3,	8·5054	0·9296948
$Na_2Si_4O_9$,	15·185	1·1814148
$Na_8Si_3O_{10}$,	5·37	0·7299743
Na_2SiF_6,	9·425	0·9742814
Na_2SO_4,	7·108	0·8517474
$Na_2SO_4 + 10H_2O$,	16·116	1·2072573
$Na_2SO_4 + 7H_2O$,	13·4136	1·1275453
$Na_2S_2O_7$,	11·111	1·0457531
$NaHSO_4$,	12·0118	1·0796182
$NaHSO_4 + 2H_2O$,	15·615	1·1935420
Na_2SO_3,	6·308	0·7998917
$Na_2SO_3 + 7H_2O$,	12·6136	1·1008390
$NaHSO_3$,	10·4118	1·0175258
$NaHSO_2$,	8·8118	0·9450646
$Na_2S_2O_3$,	7·911	0·8982314
$Na_2S_2O_3 + 5H_2O$,	12·415	1·0939467
$Na_2S_2O_6 + 2H_2O$,	12·1126	1·0832374
$Na_2S_3O_6 + 3H_2O$,	14·6164	1·1648404
$Na_2S_4O_6 + 2H_2O$,	15·3186	1·1852190
Na_2S,	3·908	0·5919546
$NaHS$,	5·6118	0·7491022
$Na_3SbS_4 + 9H_2O$,	15·9911$\dot{3}$	1·2038792
Na_2WO_4,	14·705	1·1674650
$Na_2WO_4 + 2H_2O$,	16·5066	1·2176576
$Na_2W_2O_7 + 6H_2O$,	31·7098	1·5011935

TABLE LXXVB (1).—*continued.*

Formula of Substance to be estimated.	Weight, in mgms., of Substance $\equiv$ 1 cm.^{3} $\frac{N}{10}$ Solution.	Logarithm.
Sodium—		
$Na_2W_4O_{13} + 10H_2O$,	58·513	1·7672524
$NaCN$,	4·909	0·6909930
$NaCN + 2H_2O$,	8·5122	0·9300418
$Na_4Fe(CN)_6 + 12H_2O$,	13·0133	1·1143875
$Na_3Fe(CN)_6 + H_2O$,	9·9768$\dot{6}$	0·9989941
$NaCNS$,	8·115	0·9092885
$NaC_2H_3O_2$,	8·2074	0·9142056
$NaC_2H_3O_2 + 3H_2O$,	13·6122	1·1339283
$Na_2C_2O_4$,	6·705	0·8263988
$NaHC_2O_4 + H_2O$,	13·0074	1·1131905
$Na_2C_4H_4O_6 + 2H_2O$,	11·5082	1·0610074
$NaHC_4H_4O_6 + H_2O$,	19·0106	1·2789958
Strontium—		
$Sr^{\cdot\cdot}$,	4·38	0·6414741
$SrBr_2$,	12·376	1·0925803
$SrBr_2 + 6H_2O$,	17·7808	1·2499513
$SrCO_3$,	7·38	0·8680564
$SrCl_2$,	7·925	0·8989993
$SrCl_2 + 6H_2O$,	13·3298	1·1248236
$Sr(NO_3)_2$,	10·584	1·0246498
$Sr(NO_3)_2 + 4H_2O$,	14·1872	1·1518967
SrO,	5·18	0·7143298
$Sr_3(PO_4)_2$,	7·546$\dot{6}$	0·8777551
$SrSO_4$,	9·183	0·9629846
SrS,	5·983	0·7769190
Sulphur—		
$S^{\cdot\cdot}$,	1·603	0·2049335
H_2S,	1·7038	0·2314186
SO_2,	3·203	0·5055569
H_2SO_3,	4·1038	0·6131862
H_2SO_4,	4·9038	0·6905327
SO_3,	4·003	0·6023856
S_2Br_2(est. of S),	5·601	0·7482656
,, (est. of Br),	11·202	1·0492956
S_2Cl_2(est. of S),	3·3755	0·5283381
,, (est. of Cl),	6·751	0·8293681
SCl_2,	5·148	0·7116385
SCl_4(est. of S),	8·693	0·9391697
,, (est. of Cl),	4·3465	0·6381397
S_2I_2(est. of S),	7·9455	0·9001212
,, (est. of I),	15·891	1·2011512

TABLE LXXVB (1).—*continued.*

Formula of Substance to be estimated.	Weight, in mgms., of Substance ≡ 1 cm.^{3} $\frac{N}{10}$ Solution.	Logarithm.
Tantalum—		
$Ta^{\cdot\cdot\cdot\cdot\cdot}$,	3·66	0·5634811
$TaBr_5$,	11·656	1·0665495
$TaCl_5$,	7·205	0·8576340
TaF_5,	5·56	0·7450748
Ta_2O_5,	4·46	0·6493349
Ta (in orthotantalates),	6·1	0·7853298
„ (in pyrotantalates),	9·15	0·9614211
„ (in metatantalates),	18·3	1·2624511
Tellurium—		
$Te^{\cdot\cdot}$, (In -ous compounds)	6·38	0·8048207
$TeBr_2$, (In -ous compounds)	14·76	1·1576381
$TeCl_2$, (In -ous compounds)	9·925	0·9967305
TeI_2, (In -ous compounds)	19·065	1·2802368
TeO, (In -ous compounds)	7·18	0·8561244
$Te^{\cdot\cdot\cdot\cdot}$, (In -ic compounds)	3·19	0·5037907
$TeBr_4$, (In -ic compounds)	11·186	1·0486748
$TeCl_4$, (In -ic compounds)	6·735	0·8283376
TeF_4, (In -ic compounds)	5·09	0·7067178
$TeF_4 + H_2O$, (In -ic compounds)	5·5404	0·7435412
TeI_4, (In -ic compounds)	15·875	1·2007137
TeO_2, (In -ic compounds)	3·99	0·6009729
Te, (Estimated as tellurates)	6·38	0·8048207
TeO_3, (Estimated as tellurates)	8·78	0·9434945
H_2TeO_4, (Estimated as tellurates)	9·6808	0·9859112
K_2TeO_4, (Estimated as tellurates)	13·495	1·1301729
$K_2TeO_4 + 5H_2O$, (Estimated as tellurates)	17·999	1·2552484
Terbium—		
$Tb^{\cdot\cdot\cdot}$,	5·333$\dot{3}$	0·7269987
Tb_2O_3,	6·133$\dot{3}$	0·7876965
Thallium—		
$Tl^{\cdot}$, (In -ous compounds)	20·41	1·3098430
TlBr, (In -ous compounds)	28·406	1·4534101
Tl_2CO_3 (In -ous compounds)	23·41	1·3694014
$TlClO_3$, (In -ous compounds)	28·755	1·4587134
TlCl, (In -ous compounds)	23·955	1·3793962
TlF, (In -ous compounds)	22·31	1·3484996
TlI, (In -ous compounds)	33·095	1·5197624
$TlNO_3$, (In -ous compounds)	26·614	1·4251102
Tl_2O, (In -ous compounds)	21·21	1·3265407
TlOH, (In -ous compounds)	22·1108	1·3446045
Tl_3PO_4, (In -ous compounds)	23·576$\dot{6}$	1·3724824
Tl_2Se, (In -ous compounds)	24·37	1·3868555
Tl_2SO_4, (In -ous compounds)	25·213	1·4016245
Tl_2S, (In -ous compounds)	22·013	1·3426792

TABLE LXXVB (1).—*continued.*

Formula of Substance to be estimated.	Weight, in mgms., of Substance ≡ 1 cm.^{3} $\frac{N}{10}$ Solution.	Logarithm.
Thallium—		
In -ic compounds, . .		
$Tl^{\cdot\cdot\cdot}$,	6·803$\dot{3}$	0·8327217
$TlBr_3$,	14·799$\dot{3}$	1·1702421
$TlCl_3$,	10·348$\dot{3}$	1·0148704
TlI_3,	19·488$\dot{3}$	1·2897747
Tl_2O_3,	7·603$\dot{3}$	0·8810040
$Tl(OH)_3$,	8·5041$\dot{3}$	0·9296300
$TlOOH$,	7·9036	0·8978249
Tl_2S_3,	8·406$\dot{3}$	0·9246066
Thorium—		
In -ous compounds, . .		
$Th^{\cdot\cdot}$,	11·625	1·0653930
$ThBr_2$,	19·621	1·2927211
In -ic compounds,		
$Th^{\cdot\cdot\cdot\cdot}$,	5·8125	0·7643630
$ThBr_4$,	13·8085	1·1401465
$ThCl_4$,	9·3575	0·9711598
ThF_4,	7·7125	0·8871952
$ThF_4 + 4H_2O$,	9·5141	0·9783677
ThO_2,	6·6125	0·8203657
$Th(OH)_4$,	7·5133	0·8758307
$Th(SO_4)_2$,	10·6155	1·0259404
$Th(SO_4)_2 + 9H_2O$,	14·6691	1·1664035
$Th(PO_3)_4$,	13·7125	1·1371166
Tin—		
In -ous compounds,		
$Sn^{\cdot\cdot}$,	5·95	0·7745170
$SnBr_2$	13·946	1·1444497
$SnCl_2$	9·495	0·9774950
$SnCl_2 + 2H_2O$,	11·2966	1·0529477
SnF_2,	7·85	0·8948697
SnI_2,	18·635	1·2703294
SnO,	6·75	0·8293038
SnS,	7·553	0·8781195
In -ic compounds,		
$Sn^{\cdot\cdot\cdot\cdot}$,	2·975	0·4734870
$SnBr_4$,	10·971	1·0402462
$SnCl_4$,	6·52	0·8142476
$SnCl_4 + 2H_2O$,	7·4208	0·8704507
$SnCl_4 + 5H_2O$,	8·772	0·9430986
$SnCl_4 + 8H_2O$,	10·1232	1·0053178
SnF_4,	4·875	0·6879746
SnI_4,	15·66	1·1947917
SnO_2,	3·775	0·5769169
$SnSe_2$,	6·935	0·8410465
SnS_2,	4·578	0·6606758
$SnOCl_2$,	5·1475	0·7115963

TABLE LXXVB (1).—*continued.*

Formula of Substance to be estimated.	Weight, in mgms., of Substance ≡ 1 cm.³ $\frac{N}{10}$ Solution.	Logarithm.
Titanium—		
Ti····,	1·2025	0·0800851
$TiBr_4$,	9·1985	0·9637170
$TiCl_4$,	4·7475	0·6764650
TiF_4,	3·1025	0·4917118
TiI_4,	13·8875	1·1426241
TiO_2,	2·0025	0·3015725
Tungsten—		
W··,	9·2	0·9637878
WBr_2, In compounds corresponding to monoxide,	17·196	1·2354274
WCl_2,	12·745	1·1053398
WI_2,	21·885	1·3401465
WO,	10	1·0000000
W····,	4·6	0·6627578
WBr_4,	12·596	1·1002326
WCl_4, In tetra-compounds from titration of the negative radicle,	8·145	0·9108911
WI_4,	17·285	1·2376694
WO_2,	5·4	0·7323938
WS_2,	6·203	0·7926018
W······,	3·066$\dot{6}$	0·4866665
WCl_6, In hexa-compounds from titration of negative radicle,	6·611$\dot{6}$	0·8203109
WO_3,	3·866$\dot{6}$	0·5873367
WS_3.	5·203$\dot{3}$	0·7162816
W,	9·2	0·9637878
WO_3, In ortho-tungstates,	11·6	1·0644580
H_2WO_4,	12·5008	1·0969378
Uranium—		
U···,	7·95	0·9003671
UBr_3, In tri-compounds,	15·946	1·2026517
UCl_3,	11·495	1·0605089
U_2S_3,	9·553	0·9801397
U····,	5·9625	0·7754284
UBr_4,	13·9585	1·1448387
UCl_4, In tetra-compounds,	9·5075	0·9780663
UF_4,	7·8625	0·8955606
UO_2,	6·7625	0·8301073
US_2,	7·5655	0·8788376
U,	11·925	1·0764584
UO_2Br_2,	21·521	1·3328624
UO_2Cl_2,	17·07	1·2322335
UO_2F_2, In uranylic compounds,	15·425	1·1882252
UO_2O,	14·325	1·1560946
$UO_2(NO_3)_2$,	19·729	1·2951051
$UO_2(NO_3)_2 + 6H_2O$,	25·1138	1·4002582

TABLE LXXVB (1).—*continued.*

Formula of Substance to be estimated.	Weight, in mgms., of Substance ≙ 1 cm.^{3} $\frac{N}{10}$ Solution.	Logarithm.
Uranium—		
$UO_2H_4(PO_4)_2 + 3H_2O$, In uranylic compounds,	25·929	1·4137858
$UO_2NH_4PO_4$, In uranylic compounds,	19·1786	1·2828169
$(UO_2)_2P_2O_7$, In uranylic compounds,	17·875	1·2522460
UO_2SO_4, In uranylic compounds,	18·328	1·2631151
$UO_2SO_4 + 3H_2O$, In uranylic compounds,	21·0304	1·3228475
$UO_2S_2O_7$, In uranylic compounds,	22·331	1·3489082
Vanadium—		
$V^{\cdot\cdot}$, In di-compounds,	2·56	0·4082400
VCl_2, In di-compounds,	6·105	0·7856857
$V^{\cdot\cdot\cdot}$, In tri-compounds,	1·706$\dot{6}$	0·2321487
VBr_3, In tri-compounds,	9·702$\dot{6}$	0·9868911
VCl_3, In tri-compounds,	5·251$\dot{6}$	0·7202971
VF_3, In tri-compounds,	3·606$\dot{6}$	0·5571060
$VF_3 + 3H_2O$, In tri-compounds,	5·4082$\dot{6}$	0·7330580
V_2O_3, In tri-compounds,	2·506$\dot{6}$	0·3990965
$V^{\cdot\cdot\cdot\cdot}$, In tetra-compounds,	1·28	0·1072100
VCl_4, In tetra-compounds,	4·825	0·6834973
Ytterbium—		
$Yb^{\cdot\cdot\cdot}$,	5·766$\dot{6}$	0·7609248
Yb_2O_3,	6·566$\dot{6}$	0·8173449
$Yb_2(SO_4)_3$,	10·569$\dot{6}$	1·0240612
$Yb_2(SO_4)_3 + 8H_2O$,	12·9718	1·1130012
Yttrium—		
$Y^{\cdot\cdot\cdot}$,	2·966$\dot{6}$	0·4722687
YBr_3,	10·962$\dot{6}$	1·0399162
YCl_3,	6·511$\dot{6}$	0·8136921
YF_3,	4·866$\dot{6}$	0·6872316
YI_3,	15·651$\dot{6}$	1·1945605
Y_2O_3,	3·766$\dot{6}$	0·5759571
$Y_2(SO_4)_3$,	7·769$\dot{6}$	0·8904023
$Y_2(SO_4)_3 + 8H_2O$,	10·1718	1·0073979
Zinc—		
$Zn^{\cdot\cdot}$,	3·27	0·5145477
$ZnBr_2$,	11·266	1·0517697
$ZnCl_2$,	6·815	0·8334659
ZnF_2,	5·17	0·7134905
ZnI_2,	15·955	1·2028968
ZNO,	4·07	0·6095944
$Zn(NO_3)_2$,	9·474	0·9765334
$Zn(NO_3)_2 + 6H_2O$,	14·8788	1·1725679
$Zn_3(PO_4)_2$,	6·436$\dot{6}$	0·8086610
$Zn_3(PO_4)_2 + 4H_2O$,	7·6377$\dot{3}$	0·8829645
$Zn(PO_3)_2$,	11·17	1·0480532

TABLE LXXVB (1).—*continued.*

Formula of Substance to be Estimated.	Weight, in mgms., of Substance ≡ 1 cm.[3] $\frac{N}{10}$ Solution.	Logarithm.
Zinc—		
$Zn_2P_2O_7$,	7·62	0·8819550
$ZnSO_4$,	8·073	0·9070349
$ZnSO_4 + 7H_2O$,	14·3786	1·1577166
$ZnSe$,	7·23	0·8591383
ZnS,	4·873	0·6877964
Zirconium—		
$Zr^{\cdot\cdot\cdot\cdot}$,	2·265	0·3550682
$ZrBr_4$,	10·261	1·0111897
$ZrCl_4$,	5·81	0·7641761
ZrF_4,	4·165	0·6196150
ZrO_2,	3·065	0·4864305
$Zr(OH)_4$,	3·9658	0·5983308
$Zr(NO_3)_4$,	8·469	0·9278321
$Zr(SO_4)_2$,	7·068	0·8492965
$Zr(SO_4)_2 + 4H_2O$,	8·86935	0·9478918

TABLE LXXVB (2).—**Volumetric Estimations.** (Inorganic.)

Formula of Substance to be estimated.	Method of Estimation, etc.	Weight in mgms. of Substance 1 c.cm. $\frac{N}{10}$ Solution.	Logarithm.
Aluminium—			
Al,	The Al is precipitated by caustic NaOH or KOH solution and a further quantity of the alkali is added until all the precipitate disappears; two titrations are then made with $\frac{N}{10}$ mineral acid, employing methyl orange as indicator in one case and phenolphthalein in the other. The difference between the two titrations corresponds to the Al present: Cross and Bevan find that by this method $4Al \equiv 5SO_4$.	1·084	0·0350293
$AlBr_3 + 6H_2O$,		15·00304	1·1761793
$AlCl_3$,		5·338	0·7273786
$AlCl_3 + 6H_2O$,		9·66184	0·9850600
Al_2O_3,		2·044	0·3104809
$Al(OH)_3$,		3·12496	0·4948445
$AlPO_4$,		4·884	0·6887757
$Al_2(SO_4)_3$,		6·8476	0·8355384
$Al_2(SO_4)_3 + 18H_2O$,		13·33336	1·1249396
$(NH_4)_2Al_2(SO_4)_4 + 24H_2O$,		18·13936	1·2586219
$K_2Al_2(SO_4)_4 + 24H_2O$,		18·98248	1·2783529
$Na_2Al_2(SO_4)_4 + 24H_2O$,		18·33848	1·2633633
Antimony—			
Sb,	Any compound of $Sb^{\cdot\cdot\cdot}$, brought into solution in tartaric acid and water, can be titrated with $\frac{N}{10}$ I_2 solution in presence of excess of	6·01	0·7788744
$SbBr_3$,		18·004	1·2553690
$SbCl_3$,		11·3275	1·0541341
$SbCl_5$,		14·8725	1·1723840
SbF_3,		8·86	0·9474337

TABLE LXXVB (2).—*continued.*

Formula of Substance to be estimated.	Method of Estimation, etc.	Weight in mgms. of Substance ≡1 c.cm. $\frac{N}{10}$ Solution.	Logarithm.
Antimony—			
SbF_5,	$NaHCO_3$ solution. Sb····· compounds liberate	10·76	1·0318123
Sb_2O_3,	iodine; $Sb \equiv I_2$ in both cases.	7·21	0·8579353
Sb_2O_5,	$KMnO_4$ or $K_2Cr_2O_7$ convert Sb_2O_3 into Sb_2O_5;	8·01	0·9036325
Sb_2S_3,	$Sb \equiv O$.	8·4145	0·9250283
Sb_2S_5,	The factors for the iodometric and oxida-	10·0175	1·0007593
$K_2Sb_2Q_2(C_4H_4O_6)_2+H_2O$,	tion methods are the same.	16·6195	1·2206179
Arsenic—			
As,	Iodometric methods	3·75	0·5740313
$AsCl_3$,	$As \equiv I_2$.	9·0675	0·9574876
As_4O_6,		4·95	0·6946052
As_2O_5,		5·75	0·7596678
As_4S_6,	By oxidation methods	6·1545	0·7891928
As_2S_5,	$As \equiv O$.	7·7575	0·8897218
Na_2HAsO_3,		8·5054	0·9296947
$Na_2HAsO_4+12H_2O$,	Factors same for both classes.	20·115	1·3035200
Barium—			
Ba,	Precipitate as $BaCrO_4$ and find the oxidis-	4·58	0·6608654
$BaBr_2$,	ing power of the precipitate.	9·910$\dot{6}$	0·9961028
$BaBr_2+2H_2O$,		11·117$\dot{3}$	1·0457818
$BaCO_3$	$2Ba \equiv 3O \equiv 6I$.	6·58	0·8182258
$Ba(ClO_3)_2$,		10·14$\dot{3}$	1·0061807
$BaCl_2$,		6·94$\dot{3}$	0·8415680
$BaCl_2+2H_2O$,		8·1444	0·9108591
$BaCrO_4$,		8·45	0·9268567
$Ba(NO_3)_2$,		8·716	0·9403172
BaO,		5·11$\dot{3}$	0·7087041
$Ba(OH)_2$,		5·7138$\dot{6}$	0·7569301
$Ba(OH)_2+8H_2O$,		10·5181$\dot{3}$	1·0219386
BaO_2,		5·64$\dot{6}$	0·7517921
BaO_2+8H_2O,		10·4509$\dot{3}$	1·0191550
$BaSO_4$,		7·782	0·8910912
$BaPtC_4N_4+4H_2O$,		16·9474$\dot{6}$	1·2291047
Bismuth—			
Bi,	Precipitate as basic oxalate and estimate	10·425	1·0180761
$BiCl_3$,	C_2O_4 by permanganate.	15·7425	1·1970737
BiI_3,		29·4525	1·4691222
$Bi(NO_3)_3$,	$Bi \equiv H_2C_2O_4 \equiv O$.	19·731	1·2951491
$Bi(NO_3)_3+5H_2O$,		24·235	1·3844430
$BiPO_4$,		15·175	1·1811287
Bi_2O_3,		11·625	1·0653930
$BiAsO_4$,		17·375	1·2399248
Bi_2S_3,		12·8295	1·1082077
Bi,	Precipitate as the double oxalate	5·2125	0·7170461
$BiCl_3$,	$K_2Bi_2(C_2O_4)_4$ and estimate the C_2O_4 by	7·87125	0·8960437
BiI_3,	$KMnO_4$.	14·72625	1·1680922
$Bi(NO_3)_3$,		9·8655	0·9941191
$Bi(NO_3)_3+5H_2O$,	$Bi \equiv 2H_2C_2O_4 \equiv 2O$.	12·1175	1·0834130
$BiPO_4$,		7·5875	0·8800987
Bi_2O_3,		5·8125	0·7643630
$BiAsO_4$,		8·6875	0·9388948
Bi_2S_3,		6·41475	0·8071798
Boron—			
B,	By titration with standard Ba(OH) solu-	2·2	0·3424227
B_2O_3,	tion till solution of boric acid is just clear of	7·0	0·8450980
H_3BO_3,	turbidity which forms at first. $Ba \equiv 4H_3BO_3$.	12·4048	1·0935898

TABLE LXXVB (2).—*continued.*

Formula of Substance to be estimated.	Method of Estimation, etc.	Weight in mgms. of Substance ≡1 c.cm. $\frac{N}{10}$ Solution.	Logarithm.
Chlorine—			
Cl,	In oxy-compounds (except perchlorates)	1·7725	0·2485862
Cl_2O,	the estimation may be made by digesting	2·1725	0·3369598
$HClO$,	with KI and excess of HCl and then estimat-	2·6229	0·4187817
Cl,	ing the liberated iodine.	0·88625	$\bar{1}$·9475562
Cl_2O_3,		1·48625	0·1720919
$HClO_2$,	$HClO_x \equiv xI_2$.	1·71145	0·2333642
Cl,		0·5908$\dot{3}$	$\bar{1}$·7714649
Cl_2O_5,		1·2575	0·0995080
$HClO_3$,		1·40476$\dot{3}$	0·1484895
$CHCl_3$,	With alkaline $Cu^{\cdot\cdot}$ compound $CHCl_3 \equiv 2CuO$.	2·98395	0·4747915
Chromium—			
Cr,	In chromates and dichromates ; estimated	1·73$\dot{6}$	0·2397164
Cr_2O_3,	by the oxidising power.	2·53$\dot{6}$	0·404.634
CrO_3,		3·33$\dot{6}$	0·5233128
K_2CrO_4,	$Cr_2O_7 \equiv 2CrO_3 \equiv Cr_2O_3 \equiv K_2Cr_2O_7 \equiv$	6·48	0·8115750
$K_2Cr_2O_7$,	$2K_2Cr_2O_7 \equiv 2K_2CrO_4 \equiv 3O \equiv 3I_2$.	4·908$\dot{3}$	0·6909340
CrO_2Cl_2,		5·1$\dot{6}$	0·7132104
$K_2Cr_2O_6Cl_2$,		5·82$\dot{3}$	0·7651716
Cr,	Precipitate as $Cr(OH)_3$ and oxidise by	1·73$\dot{6}$	0·2397164
$CrCl_3$,	$KMnO_4$.	5·281$\dot{6}$	0·7227709
Cr_2O_3,		2·53$\dot{6}$	0·4042634
$Cr(NO_3)_3 + 9H_2O$,	$10Cr \equiv 6KMnO_4 \equiv 15O \equiv 30I$.	13·3454$\dot{6}$	1·1253338
$CrPO_4$,		4·90$\dot{3}$	0·6904914
$CrPO_4 + 6H_2O$,		8·5065$\dot{3}$	0·9297526
$Cr_2(SO_4)_3$,		6·539$\dot{6}$	0·8155556
$Cr_2(SO_4)_3 + 18H_2O$,		11·9444$\dot{6}$	1·0771667
$(NH_4)_2Cr_2(SO_4)_4 + 24H_2O$,		15·9494$\dot{6}$	1·2027461
$K_2Cr_2(SO_4)_4 + 24H_2O$,		16·6520$\dot{6}$	1·2214681
$Cr(CNS)_3$,		7·54$\dot{6}$	0·8777551
CrO_3,		3·33$\dot{6}$	0·5233128
K_2CrO_4,		6·48	0·8115750
$K_2Cr_2O_7$,		4·908$\dot{3}$	0·6909340
CrO_2Cl_2,		5·1$\dot{6}$	0·7132104
$K_2Cr_2O_6Cl_2$,		5·823	0·7651716
Cobalt—			
Co,	$KMnO_4$ (best in the presence of HgO)	3·54	0·5490033
$CoCO_3$,	converts $Co^{\cdot\cdot}$ to $Co^{\cdot\cdot\cdot}$, *e.g.*—	7·14	0·8536983
$CoCl_2$,	$6CoCl_2 + 5HgO + 2KMnO_4 \equiv$	7·794	0·8917605
$CoCl_2 + 6H_2O$,	$3Co_2O_3 + 2MnO_2 + 2KCl + 5HgCl_2$	14·27976	1·1547210
$Co(CN)_2$,	so $2KMnO_4 \equiv 6Co \equiv 5O$.	6·6648	0·8237872
$Co(CN)_2 + 3H_2O$,		9·90768	0·9959720
$Co(NO_3)_2$,		10·9848	1·0407922
$Co(NO_3)_2 + 6H_2O$,		17·47056	1·2423068
CoO,		4·50	0·6532126
$Co_3(AsO_4)_2$,		9·10	0·9590414
$Co_3(AsO_4)_2 + 8H_2O$,		11·98256	1·0785496
$Co_3(PO_4)_2$,		7·34	0·8656961
$Co_3(PO_4)_2 + 8H_2O$,		10·22256	1·0095597
$CoSO_4$,		9·3036	0·9686511
$CoSO_4 + 7H_2O$,		16·87032	1·2271234
$CoCl_3$,		9·921	0·9965555
Co_2O_3,		4·98	0·6972294
CoS,		5·4636	0·7374789
Co_2S_3,		6·4254	0·8079002

TABLE LXXVB (2).—*continued.*

Formula of Substance to be estimated.	Method of Estimation, etc.	Weight in mgms. of Substance ≡ 1 c.cm. $\frac{N}{10}$ Solution.	Logarithm.
Cobalt—			
Co,	The cobalt is converted into Co_2O_3, this is then digested with a known volume (excess) of ferrous solution and the excess of ferrous salt estimated $Co_2O_3+2FeSO_4+3H_2SO_4=2CoSO_4+Fe_2(SO_4)_3+3H_2O$: so that $2Co \equiv 2Fe \equiv O$.	5·9	0·7708520
$CoCO_3$,		11·9	1·0755470
$CoCl_2$,		12·99	1·1136092
$Co(CN)_2$,		11·108	1·0456359
$Co(NO_3)_2$,		18·308	1·2626409
CoO,		7·5	0·8750613
$CoSO_4$,		15·506	1·1904998
$CoSO_4+7H_2O$,		28·1172	1·4489721
CoS,		9·106	0·9593276
Co_2O_3,		8·3	0·9190781
Co_2S_3,		10·709	1·0297489
Copper—			
Cu,	By iodometric methods; by reducing-action of cuprous on ferric or on silver compounds; or by $SnCl_2$: also by standard KCNS solution. In all these cases,— $2Cu \equiv O \equiv I_2 \equiv Cl_2$.	6·36	0·5024271
Cu_2Br_2,		14·356	1·1570334
Cu_2Cl_2,		9·905	0·9958545
Cu_2F_2,		8·26	0·9169800
Cu_2I_2,		19·045	1·2797810
Cu_2O,		7·16	0·8549130
$Cu_2SO_3+H_2O$,		11·2638	1·0516849
Cu_2S,	The copper may also be reduced to the metallic state, in a finely divided condition, digested with excess of ferric salt, and finally the amount of ferrous iron estimated by oxidation. In this case all the accompanying factors must be halved.	7·963	0·9010767
$Cu_2(CNS)_2$,		12·17	1·0852906
$Cu(C_2H_3O_2)_2+H_2O$,		19·9664	1·3002911
$CuCO_3$,		12·36	1·0920185
$CuCl_2$,		13·45	1·1287223
$CuCl_2+2H_2O$,		17·0532	1·2318059
CuO,		7·96	0·9009131
$Cu(NO_3)_2$,		18·768	1·2734180
$Cu(NO_3)_2+3H_2O$,		24·1728	1·3833270
$Cu_3(PO_4)_2$,		12·69$\dot{3}$	1·1035756
$Cu_3(PO_4)_2+3H_2O$,		14·4949$\dot{3}$	1·1612162
$Cu_3(AsO_4)_2$,		15·62$\dot{6}$	1·1938663
$Cu_3(AsO_4)_2+2H_2O$,		16·8277$\dot{3}$	1·2260256
$CuHAsO_3$,		18·7608	1·2732514
$CuSO_4$,		15·966	1·2031961
$CuSO_4+5H_2O$,		24·974	1·3974881
CuS,		9·566	0·9807304
Iodine—			
I,	Iodides can be estimated by titration with $KMnO_4$. $KI+2KMnO_4=KIO_3+K_2O+2MnO_2$ $I \equiv 5O$.	1·2685	0·1032905
HI,		1·27858	0·1067279
NaI,		1·499	0·1758016
KI,		1·66	0·2201081
Iron—			
Fe,	By oxidation, reduction or iodometric methods, *i.e.* conversion of $Fe^{\cdot\cdot}$ to $Fe^{\cdot\cdot\cdot}$ or *vice versâ.* $2Fe \equiv O \equiv I_2 \equiv 2Na_2S_2O_3 \equiv SnCl_2$.	5·59	0·7474118
$FeBr_2$,		21·582	1·3340917
$FeCO_3$,		11·59	1·0640834
$FeCl_2$,		12·68	1·1031193
FeF_2,		9·39	0·9726656
$Fe(NO_3)_2$,		17·998	1·2552242
FeO,		7·19	0·8567289
$FeSO_4$,		15·196	1·1817293
$FeSO_4+7H_2O$,		27·8072	1·4441572
$Fe(NH_4)_2(SO_4)_2+6H_2O$,		39·226	1·5935740
FeS,		8·796	0·9442852
$FeSO_3$,		13·596	1·1334112

TABLE LXXVB. (2).—*continued.*

Formula of Substance to be estimated.	Method of Estimation, etc.	Weight in mgms. of Substance ≡1 c.cm. $\frac{N}{10}$ Solution.	Logarithm.
Iron—			
$Fe(C_2H_3O_2)_2+4H_2O$,	By oxidation, reduction or iodometric methods, *i.e.* conversion of $Fe^{\cdot\cdot}$ to $Fe^{\cdot\cdot\cdot}$ or *vice versâ*. $2Fe \equiv O \equiv I_2 \equiv 2Na_2S_2O_3 \equiv SnCl_2$.	24·6012	1·3909563
$FeC_2O_4+2H_2O$,		17·9932	1·2551084
$Fe(NH_4)_2(C_2O_4)_2+3H_2O$,		32·2092	1·5079799
$FeK_2(C_2O_4)_2+2H_2O$,		34·6232	1·5393672
$FeC_4H_4O_6$,		20·3932	1·3094854
$K_4Fe(CN)_6$,		36·874	1·5667203
Fe_2Br_6,		29·578	1·4709688
Fe_2Cl_6,		16·225	1·2101847
$Fe_2Cl_6+6H_2O$,		21·6298	1·3350525
$Fe_2Cl_6+12H_2O$,		27·0346	1·4319199
$K_4Fe_2Cl_{10}+2H_2O$,		32 9466	1·5178106
$(NH_4)_4Fe_2Cl_{10}+2H_2O$,		28·731	1·4583507
Fe_2F_6,		11·29	1·0526939
$Fe_2(NO_3)_6$,		24·202	1·3838513
$Fe_2(NO_3)_6+12H_2O$,		35·0116	1·5442119
Fe_2O_3,		7·99	0·9025468
$Fe_2(SO_4)_3$,		19·999	1·3010083
$Fe_2(SO_4)_3+9H_2O$,		28·1062	1·4488021
$K_2Fe_2(SO_4)_4+24H_2O$,		50·3362	1·7018804
$(NH_4)_2Fe_2(SO_4)_4+24H_2O$,		48·2284	1 6833029
$Fe_2(C_2H_3O_2)_6+4H_2O$,		26·9004	1·4297587
$Fe_2(C_2O_4)_3$,		18·79	1·2739268
$Fe_2(C_4H_4O_6)_3$,		27·7948	1·4439636
$H_6Fe_2(CN)_{12}$,		21·5164	1·3327696
$K_6Fe_2(CN)_{12}$,		32 959	1·5179740
$Fe_2(CNS)_6+3H_2O$,		25 7224	1·4103115
Fe_3Cl_8,	Estimation of total Fe by preceding methods.	15·04$\dot{3}$	1·1773440
$Fe_3Cl_8+18H_2O$,		25·8529$\dot{3}$	1·4125098
Fe_3O_4,		7·72$\dot{3}$	0 8878047
$Fe_3(SO_4)_4$,		18·398	1·2647706
$Fe_3(SO_4)_4+12H_2O$,		25·6044	1·4083145
Fe_3Cl_8,	By direct oxidation from ferrosoferric state to ferric $6Fe \equiv O \equiv I_2$	45·13	1·6544653
$Fe_3Cl_8+18H_2O$,		77·5588	1·8896311
Fe_3O_4,		23·17	1·3649260
$Fe_3(SO_4)_4$,		55·194	1·7418919
$Fe_3(SO_4)_4+12H_2O$,		76·8132	1·8854358
Lead—			
Pb,	Precipitating the lead as $PbCrO_4$, and estimating the CrO_4'' by iodometric or oxidimetric methods. $2Pb \equiv 3O \equiv 6I$.	6·89$\dot{6}$	0·8386392
$PbBr_2$,		12·227$\dot{3}$	1·0873317
$PbCO_3$,		8·89$\dot{6}$	0·9492273
$Pb_3H_2(CO_4)_2$,		8·6079$\dot{5}$	0·9349000
$PbCl_2$,		9·26	0·9666109
PbF_2,		8·16$\dot{3}$	0·9118675
PbI_2,		15·35$\dot{3}$	1·1862026
$Pb(NO_3)_2$,		11·032$\dot{6}$	1·0426805
$Pb(NO_2)_2$,		9·966	0·9985208
PbO,		7·43	0·8709888
Pb_2O_3,		7·69$\dot{6}$	0·8863026
Pb_3O_4,		7·60$\dot{7}$	0·8812578
PbO_2,		7·96$\dot{3}$	0·9010948
$PbSO_4$,		10·098$\dot{6}$	1·0042640
Pb_2SO_5,		8·764$\dot{3}$	0·9427188
PbS,		7·965$\dot{3}$	0·9012039

TABLE LXXVB. (2).—*continued.*

Formula of Substance to be estimated.	Method of Estimation, etc.	Weight in mgms. of Substance $\equiv$1 c.cm. $\frac{N}{10}$ Solution.	Logarithm.
Manganese—			
Mn,	Direct titration by $KMnO_4$	1·65	0·2174840
$MnBr_2$,	$3MnSO_4+2KMnO_4+2H_2O=$	6·4476	0·8093981
$MnBr_2+4H_2O$,	$K_2SO_4+2H_2SO_4+5MnO_2$	8·60952	0·9349790
$MnCO_3$,	$3Mn\equiv2KMnO_4$.	3·45	0·5378191
$MnCl_2$,		3·777	0·5771470
$MnCl_2+4H_2O$,		5·93892	0·7737075
MnF_2,		2·79	0·4456042
MnI_2,		9·261	0·9666579
MnI_2+4H_2O,		11·42392	1·0577772
$Mn(NO_3)_2$,		5·3724	0·7301684
$Mn(NO_3)_2+6H_2O$,		8·61528	0·9352695
MnO,		2·13	0·3283796
Mn_3O_4,		2·29	0·3598355
Mn_2O_3,		2·37	0·3747484
MnO_2,		2·61	0·4166406
Mn_2O_7,		3·33	0·5224443
$Mn_3(PO_4)_2$,		3·55	0·5502284
$Mn_3(PO_4)_2+7H_2O$,		4·81112	0·6822462
$MnHPO_4+3H_2O$,		6·15168	0·7889938
$MnH_4(PO_4)_2+2H_2O$,		8·55192	0·9320636
$Mn_2P_2O_7$,		4·26	0·6294096
$MnHAsO_4$,		5·85024	0·7671737
$MnH_4(AsO_4)_2$,		10·11096	1·0047925
$MnSO_4$,		4·5318	0·6562708
$MnSO_4+4H_2O$,		6·69372	0·8256676
$MnSO_4+5H_2O$,		7·2342	0·8593906
$MnSO_4+7H_2O$,		8·31516	0·9198707
$MnAl_2(SO_4)_4+24H_2O$,		27·77472	1·4436497
MnS,		2·6118	0·4169400
$MnS_2O_6+3H_2O$,		8·07504	0·9071448
$NaMnO_4$,		4·1715	0·6202923
$KMnO_4$,		4·6545	0·6678731
Mercury—			
Hg,	By precipitating the mercury as Hg_2Cl_2	20	1·3010300
Hg_2Br_2,	and titrating with $\frac{N}{10}$ iodine solution.	27·996	1·4470960
Hg_2Cl_2,		23·545	1·3718987
Hg_2F_2,		21·9	1·3404441
Hg_2I_2,	$Hg_2Cl_2+6KI+I_2=2K_2HgI_4+2KCl$.	32·685	1·5143485
$Hg_2(NO_3)_2$,	$Hg\equiv I$.	26·204	1·4183676
$Hg_2(NO_3)_2+2H_2O$,	The same factors also serve for the estima-	28·0016	1·4471828
Hg_2O,	tion of Hg by digesting it as $HgCl_2$ with a	20·8	1·3180633
$HgBr_2$,	known quantity of $FeCl_2$ (in excess) and	35·992	1·5562060
$HgCl_2$,	estimating the unaltered $FeCl_2$ by $KMnO_4$.	27·09	1·4328090
HgF_2+2H_2O,		27·4032	1·4378013
HgI_2,		45·37	1·6567688
$Hg(NO_3)_2$,		32·408	1·5106522
HgO,		21·6	1·3344538
$HgSO_4$,		29·606	1·4713797
Hg_3SO_6,		72·806	1·8621672
HgS,		23·206	1·3656003
$Hg(CN)_2$,		25·206	1·4015384
K_2HgI_4,		78·57	1·8952568
Hg,	By converting all the mercury into $HgCl_2$	5	0·6989700

TABLE LXXVB. (2).—*continued.*

Formula of Substance to be estimated.	Method of Estimation, etc.	Weight in mgms. of Substance ≡1 c.cm. $\frac{N}{10}$ Solution.	Logarithm.
Mercury—			
Hg_2Br_2,	and running the solution into $\frac{N}{10}$ solution of	6·999	0·8450360
Hg_2Cl_2,	KI until a very slight red turbidity becomes	5·88625	0·7698387
Hg_2F_2,	permanent, *i.e.* until the equation	5·475	0·7383841
Hg_2I_2,	$4KI + HgCl_2 = K_2HgI_3 + 2KCl$	8·17125	0·9122885
$Hg_2(NO_3)_2$,	is just overstepped.	6·551	0·8163076
$Hg_2(NO_3)_2 + 2H_2O$,		7·0004	0·8451228
Hg_2O,		5·2	0·7160033
$HgBr_2$,		8·998	0·9541460
$HgCl_2$,		6·7725	0·8307490
$HgF_2 + 2H_2O$,		6·8508	0·8357413
HgI_2,		11·3425	1·0547088
$Hg(NO_3)_2$,		8·102	0·9085922
HgO,		5·4	0·7323938
$HgSO_4$,		7·4015	0·8693197
Hg_3SO_6,		18·2015	1·2601072
HgS,		5·8015	0·7635403
$Hg(CN)_2$,		6·3015	0·7994784
K_2HgI_4,		19·6425	1·2931968
Hg,	By getting all the Hg in the mercurous	40	1·6020600
Hg_2Br_2	condition and titrating directly against $\frac{N}{10}$	55·992	1·7481260
Hg_2Cl_2.	$Na_2S_2O_3$	47·09	1·6729287
Hg_2F_2,	$Hg_2(NO_3)_2 + Na_2S_2O_3 + H_2O =$	43·8	1·6414741
Hg_2I_2,	$HgS + Hg + Na_2SO_4 + 2HNO_3$	65·37	1·8153785
$Hg_2(NO_3)_2$,	so,—	52·408	1·7193976
$Hg_2(NO_3)_2 + 2H_2O$,	$I \equiv 2Hg.$	56·0032	1·7482128
Hg_2O,		41·6	1·6190933
$HgBr_2$,		71·984	1·8572360
$HgCl_2$,		54·18	1·7338390
$HgF_2 + 2H_2O$,		54·8064	1·7388313
HgI_2,		90·74	1·9577988
$Hg(NO_3)_2$,		64·816	1·8116822
HgO,		43·2	1·6354838
$HgSO_4$,		59·212	1·7724097
Hg_3SO_6,		48·537$\dot{3}$	1·6860759
HgS,		46·412	1·6666303
$Hg(CN)_2$,		50·416	1·7025684
Hg,	By getting all the Hg in the mercuric	30	1·4771213
Hg_2Br_2,	state, say, as $HgCl_2$ and titrating directly	41·994	1·6231873
Hg_2Cl_2,	against $\frac{N}{10}$ $Na_2S_2O_3$	35·3175	1·5479900
Hg_2F_2,	$3HgCl_2 + 2Na_2S_2O_3 + 2H_2O =$	32·85	1·5165354
Hg_2I_2,	$2HgS.HgCl_2 + 2Na_2SO_4 + 4HCl$	49·0275	1·6904398
$Hg_2(NO_3)_2$,	so	39·306	1·5944589
$Hg_2(NO_3)_2 + 2H_2O$,	$I \equiv 3Hg/2.$	42·0024	1·6232741
Hg_2O,		31·2	1·4941546
$HgBr_2$,		53·988	1·7322973
$HgCl_2$,		40·635	1·6089003
$HgF_2 + 2H_2O$,		41·1048	1·6138926
HgI_2,		68·055	1·8328601
$Hg(NO_3)_2$,		48·612	1·6867435
HgO,		32·4	1·5105451
$HgSO_4$,		44·409	1·6474710
Hg_3SO_6,		36·403	1·5611372
HgS,		34·809	1·5416916
$Hg(CN)_2$,		37·812	1·5776297

TABLE LXXVB (2).—*continued.*

Formula of Substance to be estimated.	Method of Estimation, etc.	Weight in mgms. of Substance $\equiv$ 1 c.cm. $\frac{N}{10}$ Solution.	Logarithm.
Molybdenum—			
Mo,	Reduce by Zn and titrate by $KMnO_4$.	3·2	0·5051500
$MoBr_2$,	$2Mo_2O_3+3O_2=4MoO_3$.	8·530$\dot{6}$	0·9309829
$MoBr_3$,	$I\equiv Mo/3$.	11·196	1·0490628
$MoBr_4$,		13·861$\dot{3}$	1·1418050
$MoCl_2$,		5·56$\dot{3}$	0·7453350
$MoCl_3$,		6·745	0·8289819
$MoCl_4$,		7·92$\dot{6}$	0·8990906
$MoCl_5$,		9·108$\dot{3}$	0·9594389
MoI_4,		20·11$\dot{3}$	1·3034840
MoO,		3·7$\dot{3}$	0·5720967
Mo_2O_3,		4	0·6020600
MoO_2,		4·2$\dot{6}$	0·6300887
MoO_3,		4·8	0·6812412
MoS_2,		5·337$\dot{3}$	0·7273243
MoS_3,		6·406	0·8065869
H_2MoO_4,		5·4005$\dot{3}$	0·7324366
$H_2Mo_2O_7$,		5·1002$\dot{6}$	0·7075928
$(NH_4)_2MoO_4$,		6·5381$\dot{3}$	0·8154537
$BaMoO_4$,		9·91$\dot{3}$	0·9962197
$CoMoO_4$,		7·3	0·8633228
$PbMoO_4$,		12·23	1·0874264
$(NH_4)_6Mo_7O_{24}+4H_2O$,		5·88808	0·7699734
$K_6Mo_7O_{24}+4H_2O$,		6·49030	0·8122651
$Na_2Mo_{10}O_{31}+13H_2O$,		5·78769$\dot{3}$	0·7625054
$H_3PO_4(MoO_3)_{11}$,		5·09704$\dot{2}$	0·7073183
$(NH_4)_3PO_4(MoO_3)_{11}+6H_2O$,		5·5797$\dot{3}$	0·7466135
Nitrogen—			
N,	Nitrates may be estimated by the amount	0·468	$\bar{1}$·6702458
HNO_3,	of ferrous compounds they can convert to	2·1016	0·3225500
$NaNO_3$,	ferric.	2·836$\dot{3}$	0·4527572
KNO_3,	$3FeCl_2+KNO_3+4HCl=3FeCl_3+KCl+2H_2O+NO$	3·373	0·5280163
$AgNO_3$,	where	5·665$\dot{6}$	0·7532510
$Pb(NO_3)_2$,	$N\equiv 3Cl$.	5·516$\dot{3}$	0·7416505
N,	Nitrites may be estimated iodometrically.	1·404	0·1473671
HNO_2,	$2HI+2HNO_2=2H_2O+2NO+I_2$	4·7048	0·6725112
$NaNO_2$,	If nitrites are estimated by $KMnO_4$ the	6·909	0·8394152
KNO_2,	factors are exactly halves of these.	8·519	0·9303886
Sulphur—			
S,	In sulphides and sulphites with both	6·412	0·8069935
$H_2S_2O_3$,	iodometric and oxidimetric methods S acts	11·4136	1·0574227
$(NH_4)_2S_2O_3$,	as a diad, and factors, etc., for such cases	14·8264	1·1710357
BaS_2O_3,	have already been given. In thiosulphates	24·952	1·3971054
$CaS_2O_3+6H_2O$,	when estimated by iodometric methods	26·0316	1·4155009
$K_2S_2O_3$,		19·042	1·2797126
$Na_2S_2O_3$,	$I\equiv 2S$.	15·822	1·1992614
$Na_2S_2O_3+5H_2O$,		24·83	1·3949767
$Ag_2Na_2(S_2O_3)_2+H_2O$,		25·2108	1·4015867
$Ag_2Na_4(S_2O_3)_3+2H_2O$,		22·6817$\dot{3}$	1·3556762
$SrS_2O_3+5H_2O$,		28·98	1·4620984
ZnS_2O_3,		17·752	1·2492473
S,	When thiosulphates are titrated with	0·8015	$\bar{1}$·9039035
$H_2S_2O_3$,	$KMnO_4$ the reaction is	1·4267	0·1543327
$(NH_4)_2S_2O_3$,	$Na_2S_2O_3+2O_2+H_2O=2NaHSO_4$	1·8533	0·2679457
BaS_2O_3,	so $S\equiv O_2$.	3·119	0·4940154

TABLE LXXVB (2).—*continued.*

Formula of Substance to be estimated.	Method of Estimation, etc.	Weight in mgms. of Substance ≡ 1 c.cm. $\frac{N}{10}$ Solution.	Logarithm.
Sulphur—			
$CaS_2O_3+6H_2O$,		3·25395	0·5124109
$K_2S_2O_3$,		2·38025	0·3766226
$Na_2S_2O_3$,		1·97775	0·2961714
$Na_2S_2O_3+5H_2O$,		3·10375	0·4918867
$Ag_2Na_2(S_2O_3)_2+H_2O$,		3·15135	0·4984967
$Ag_2Na_4(S_2O_3)_3+2H_2O$,		$2·83521\dot{6}$	0·4525862
$SrS_2O_3+5H_2O$,		3·6225	0·5590084
ZnS_2O_3,		2·219	0·3461573
Thallium—			
Tl,	Reduce to the thallous state and titrate with $KMnO_4$. Tl≡O.	10·205	1·0088130
TlBr,		14·203	1·1523801
TlCl,		11·9778	1·0783662
TlF,		11·155	1·0474696
TlI,		16·5475	1·2187324
Tl_2O,		10·605	1·0255107
TlOH,		11·0554	1·0435745
Tl_2Se,		12·185	1·0858255
Tl_2S,		11·0065	1·0416492
Tl_2CO_3,		11·705	1·0683714
$TlClO_3$,		14·3775	1·1576834
$TlNO_3$,		13·307	1·1240802
Tl_2SO_4,		12·6065	1·1005945
Tl_3PO_4,		11·7883	1·0714524
$TlBr_3$,		22·199	1·3463334
$TlCl_3$,		15·5225	1·1909617
TlI_3,		29·2325	1·4658660
Tl_2O_3,		11·405	1·0570953
$Tl(OH)_3$,		12·7562	1·1057213
TlOOH,		11·8554	1·0739162
Tl_2S_3,		12·6095	1·1006979
Uranium—			
U,	Reduce by Zn, then titrate with $KMnO_4$ U≡O.	11·925	1·0764584
UBr_3,		23·919	1·3787430
UBr_4,		27·917	1·4458687
UCl_3,		17·2425	1·2366002
UCl_4,		19·015	1·2790963
UF_4,		15·725	1·1965906
UO_2,		13·525	1·1311373
U_3O_8,		$14·058\dot{3}$	1·1479338
UO_3,		14·325	1·1560946
U_2S_3,		14·3295	1·1562310
UO_2Br_2,		21·521	1·3328624
UO_2Cl_2,		17·07	1·2322335
UO_2F_2,		15·425	1·1882252
$UO_2(NO_3)_2$,		19·729	1·2951051
$UO_2(NO_3)_2+6H_2O$,		25·1338	1·4002582
$UO_2H_4P_2O_8+3H_2O$,		25·929	1·4137858
$UO_2NH_4PO_4$,		19·1786	1·2828169
$(UO_2)_2P_2O_7$,		17·875	1·2522460
UO_2SO_4,		18·328	1·2631151
$UO_2SO_4+3H_2O$,		21·0304	1·3228475
H_2UO_4,		15·2258	1·1825802
K_2UO_4,		19·04	1·2796669
Na_2UO_4,		17·43	1·2412974

TABLE LXXVB (2).—*continued.*

Formula of Substance to be estimated.	Method of Estimation, etc.	Weight in mgms. of Substance $\equiv$1 c.cm. $\frac{N}{10}$ Solution.	Logarithm.
Vanadium—			
V,	Oxidise to V_2O_5 or corresponding compound, digest with known quantity (excess) of ferrous compound, and estimate the excess. $2FeO + V_2O_5 = Fe_2O_3 + V_2O_4$ $V_2 \equiv O$.	5·12	0·7092700
VBr_3.		29·108	1·4640124
VCl_2,		12·21	1·0867157
VCl_3,		15·755	1·1974184
VCl_4,		19·3	1·2855573
VF_3,		10·82	1·0342273
$VF_3 + 3H_2O$,		16·2248	1·2101793
V_2O_2,		6·72	0·8273693
V_2O_3,		7·52	0·8762178
V_2O_4,		8·32	0·9201233
V_2O_5,		9·12	0·9599948
$VO.SO_4$,		16·326	1·2128798
NH_4VO_3,		11·7272	1·0691943
KVO_3,		13·835	1·1409792
K_3VO_4,		23·265	1·3667031
$K_4V_2O_7$,		18·55	1·2683439
Zinc—			
Zn,	Precipitate Zn as ferricyanide, digest well washed ppt. with excess of KI and acetic acid; estimate the amount of iodine liberated. $I \equiv \frac{3}{2} Zn$	9·81	0·9916690
$ZnBr_2$,		33·798	1·5288910
$ZnCl_2$,		20·445	1·3105872
ZnF_2,		15·51	1·1906118
ZnI_2,		47·865	1·6800181
ZnO,		12·21	1·0867157
$Zn(NO_3)_2$,		28·422	1·4536547
$Zn(NO_3)_2 + 6H_2O$,		44·6364	1·6496892
$Zn_3(PO_4)_2$,		19·31	1·2857823
$Zn_3(PO_4)_2 + 4H_2O$,		22·9132	1·3600858
$Zn(PO_3)_2$,		33·51	1·5251745
$Zn_2P_2O_7$,		22·86	1·3590762
$ZnSO_4$,		24·219	1·3841562
$ZnSO_4 + 7H_2O$,		43·1358	1·6348379
$ZnSe$,		21·69	1·3362596
ZnS,		14·619	1·1649177

TABLE LXXVB (3).—Volumetric Estimations. (Organic.)

Formula of Substance to be estimated.	Method of Estimation, etc.	Weight in mgms. of Substance $\equiv$1 c.cm. $\frac{N}{10}$ Solution.	Logarithm.
Cyanogen and its derivatives—			
CN,	By precipitation with $\frac{N}{10}$ silver solution or similar precipitant: complete precipitation of the cyanogen radicle. For the cyanides the same factors are to be employed when the CN is titrated with $\frac{N}{10}$ $HgCl_2$ solution run into the cyanide solution in presence of a little NH_4OH, the final point being indicated by a faint opalescence.	2·604	0·4156410
HCN,		2·7048	0·4321352
NH_4CN,		4·4112	0·6445567
KCN,		6·519	0·8141810
$NaCN$,		4·909	0·6909930
$Ba(CN)_2+2H_2O$,		11·2312	1·0504262
$Hg(CN)_2$,		12·104	1·1005084
$AgCN$,		14·4	1·1583625
$TlCN$,		11·514	1·3619921
CNS',		5·810	0·7641761
$HCNS$,		5·9108	0·7716463
NH_4CNS,		7·6172	0·8817954
$NaCNS$,		8·115	0·9092885
$KCNS$,		9·725	0·9878896
FeC_6N_6'''',		5·3035	0·7245626
$H_4FeC_6N_6$,		5·4043	0·7327394
$Na_4FeC_6N_6+10H_2O$,		12·1125	1·0832338
$K_4FeC_6N_6+3H_2O$,		10·5697	1·0240626
$(NH_4)_4FeC_6N_6+3H_2O$,		8·4619	0·9274679
$Fe_4^{\cdots}(FeC_6N_6)_3''''$,		7·1668$\dot{3}$	0·8553274
FeC_6N_6''',		7·071$\dot{3}$	0·8495013
$H_3FeC_6N_6$,		7·1721$\dot{3}$	0·8556483
$K_3FeC_6N_6$,		10·986$\dot{3}$	1·0408527
$Fe_3^{\cdot\cdot}(FeC_6N_6)_2'''$,		9·866$\dot{3}$	0·9941557
$K_4CoC_6N_6$,		9 296	0·9682961
$K_3CoC_6N_6$,		11·089$\dot{6}$	1·0449184
CN,	By conversion of the cyanogen into alkaline cyanide, KCN say, and titration with $\frac{N}{10}$ $AgNO_3$ till faint turbidity becomes permanent, *i.e.* until one just oversteps the equation. $2KCN+AgNO_3=KAg(CN)_2+KNO_3$.	5·208	0·7166710
HCN,		5·4096	0·7331652
NH_4CN,		8·8224	0·9455867
KCN,		13·038	1·1152110
$NaCN$,		9·818	0·9920230
$Ba(CN)_2+2H_2O$,		22·4624	1·3514562
$Hg(CN)_2$,		24·208	1·4015384
$AgCN$,		28·8	1·4593925
$TlCN$,		23·028	1·6630221
$H_4FeC_6N_6$,		7·2057$\dot{3}$	0·8576781
$K_4FeC_6N_6+3H_2O$,		14·0929$\dot{3}$	1·1490013
$H_3FeC_6N_6$,		7·1721$\dot{3}$	0·8556483
$K_3FeC_6N_6$,		10·9863	1·0408527
$K_4FeCoC_6N_6$,		12·394$\dot{6}$	1·0932348
$K_3CoC_6N_6$,		11·089$\dot{6}$	1·0449184
CN,	By converting all the cyanogen into KCN and titrating against $\frac{N}{10}$ iodine, $KCN+I_2=KI+ICN$, so $I\equiv\frac{1}{2}CN$.	1·302	0·1146110
HCN,		1·3524	0·1311052
NH_4CN,		2·2056	0·3435267
KCN,		3·2595	0·5131510
$NaCN$,		2·4545	0·3899630
$Ba(CN)_2+2H_2O$,		5·6156	0·7493962
$Hg(CN)_2$,		6·302	0·7994784
$AgCN$,		7·2	0·8573325
KCN,		11·507	1·0609621
$H_4FC_6N_6$,		1·8014$\dot{3}$	0·2556182
$K_4FC_6N_6+3H_2O$,		3·5232$\dot{3}$	0·5469413
FeC_6N_6'''',	Ferrocyanides in very dilute acid solutions	21·214	1·3266226

TABLE LXXVB (3).—*continued.*

Formula of Substance to be estimated.	Method of Estimation, etc.	Weight in mgms. of Substance ≡1 c.cm. $\frac{N}{10}$ Solution.	Logarithm.
Cyanogen and its derivatives—			
$H_4FeC_6N_6$,	are converted by $KMnO_4$ into ferricyanides.	21·6172	1·3347994
$(NH_4)_4FeC_6N_6+3H_2O$,	$2H_4FeC_6N_6+O=2H_3FeC_6N_6+H_2O$,	33·8476	1·5295279
$K_4FeC_6N_6+3H_2O$,	so $O \equiv 2FeC_6N_6''''$.	42·2788	1·6261226
$Na_4FeC_6N_6+10H_2O$,		48·45	1·6852938
$Fe_4^{\cdots}(FeC_6N_6)_3''''$,		28·667$\dot{3}$	1·4573873
FeC_6N_6''',	Ferricyanides in presence of HCl react	21·214	1·3266226
$H_3FeC_6N_6$,	with KI thus:	21·5164	1·3327696
$(NH_4)_3FeC_6N_6+3H_2O$,	$2K_3FeC_6N_6+2KI=2K_4FeC_6N_6+I_2$,	32·0404	1·5056979
$K_3FeC_6N_6$,	so $I \equiv FeC_6N_6'''$.	32·959	1·5179740
$Na_3FeC_6N_6+H_2O$,		29·9306	1·4761154
CNS,	Thiocyanates titrated with $KMnO_4$.	0·968$\dot{3}$	$\bar{1}$·9860247
HCNS,	$O \equiv \frac{1}{3}CNS$.	0·9851$\dot{3}$	$\bar{1}$·9934950
NH_4CNS,		1·2695$\dot{3}$	0·1036441
KCNS,		1·62083	0·2097383
NaCNS,		1·3525	0·1311372
AgCNS,		2·7671$\dot{6}$	0·4420353
CuCNS,		2·028$\dot{3}$	0·3071893
Organic acids and their corresponding compounds—			
HCOOH,	By acidimetric methods.	4·6016	0·6629089
$HCOONH_4$,	By acidimetric and alkalimetric methods:	6·308	0·7998917
HCOOK,	distillation, ignition, or precipitation being	8·4158	0·9250954
$HCOONa+H_2O$,	sometimes necessary.	8·6074	0·9348720
HCOOAg,		15·2938	1·1845154
CH_3COOH,		6·0032	0·7783828
CH_3COONH_4,		7·7094	0·8870206
CH_3COOK,		9·8174	0·9919965
$CH_3COONa+3H_2O$,		13·6122	1·1339283
CH_3COOAg,		16·6954	1·2225968
$(CH_3COO)_2Ca+H_2O$,		8·8082	0·9448872
$(CH_3COO)_2Cu+H_2O$,		9·9832	0·9992698
$(CH_3COO)_2Pb+3H_2O$,		18·9498	1·2776047
C_2H_5COOH,		7·4048	0·8695133
C_3H_7COOH,		8·8064	0·9447981
C_4H_9COOH,		10·208	1·0089407
$C_5H_{11}COOH$,		11·6096	1·0648173
$C_6H_{13}COOH$,		13·0112	1·1143174
$C_7H_{15}COOH$,		14·4128	1·1587484
$C_8H_{17}COOH$,		15·8144	1·1990527
$C_9H_{19}COOH$,		17·216	1·2359323
$C_{11}H_{23}COOH$,		20·0192	1·3014467
$C_{13}H_{27}COOH$,		22·8224	1·3583613
$C_{15}H_{31}COOH$,		25·6256	1·4086741
$C_{16}H_{33}COOH$,		27·0272	1·4318011
$C_{17}H_{35}COOH$,		28·4288	1·4537586
C_2H_3COOH,		7·2032	0·8575255
C_3H_5COOH,		8·6048	0·9347408
C_4H_7COOH,		10·0064	1·0002779
$C_{17}H_{33}COOH$,		28·2272	1·4506678
$C_{21}H_{41}COOH$,		33·8336	1·5293482
$(COOH)_2$,		4·5008	0·6532897
$(COOH)_2+2H_2O$,		6·3024	0·7995057

TABLE LXXVB (3).—*continued.*

Formula of substance to be estimated.	Method of Estimation, etc.	Weight in mgms. of Substance $\equiv$ 1 c.cm. $\frac{N}{10}$ Solution.	Logarithm.
Organic acids and their corresponding compounds—			
$(COONH_4)_2 + H_2O$,	By acidimetric and alkalimetric methods; distillation, ignition or precipitation being sometimes necessary.	7·108	0·8517474
$COOHCOONH_4 + H_2O$,		6·2548	0·7962132
$(COONa)_2$,		6·705	0·8263988
$COOHCOONa + H_2O$,		6·5037	0·8131604
$COOKCOOK + H_2O$,		9·7158	0·9874786
$(COOH)_2COOK)_2 + H_2O$,		6·5853	8·8362165
$COOK(COOH)_3 + 2H_2O$,		8·55515	0·9322276
$(COO)_2Ca + H_2O$,		7·3058	0·8636676
$(COO)_2Fe + 2H_2O$,		8·9966	0·9540784
$(COOK)_2(COO)_2Fe + 2H_2O$		8·6558	0·9373072
$CH_2(COOH)_2$,		5·2016	0·7161369
$C_2H_4(COOH)_2$,		5·9024	0·7710286
$C_2H_4(COONH_4)_2$,		7·6088	0·8813162
$C_2H_4(COOH)(COONH_4)$,		6·7556	0·8296639
$C_2H_4(COOK)_2 + 3H_2O$,		12·419	1·0940866
$C_2H_4(COONa)_2 + 6H_2O$,		13·5114	1·1307004
$C_2H_4(COOAg)_2$,		16·5946	1·2199668
$C_2H_4(COO)_2Ba$,		12·6716	1·1028314
$C_2H_2(COOH)_2$,		5·8016	0·7635478
$CH_2OHCOOH$,		7·6032	0·8809964
$C_2H_4OHCOOH$,		9·0048	0·9544741
$C_2H_3OH(COOH)_2$,		6·7024	0·8262303
$(CHOH)_2(COOH)_2$,		7·5024	0·8752002
$(NH_4)_2C_4H_4O_6$,		9·2088	0·9642081
$(K_2C_4H_4O_6)_2 + H_2O$,		11·767	1·0706657
$KHC_4H_4O_6$,		9·4095	0·9735665
$Na_2C_4H_4O_6 + 2H_2O$,		11·5082	1·0610074
$KNa(C_4H_4O_6) + 4H_2O$,		14·1148	1·1496747
$K_2(SbO)_2(C_4H_4O_6)_2 + H_2O$,		16·6195	1·2206179
$C_3H_4OH(COOH)_3$,		$6{\cdot}4021\dot{3}$	0·8063246
$C_3H_4OH(COOH)_3 + H_2O$,		$7{\cdot}002\dot{6}$	0·8452634
$(NH_4)_3C_6H_5O_7 + H_2O$,		$8{\cdot}7090\dot{6}$	0·9399715
$(NH_4)_2HC_6H_5O_7$,		$7{\cdot}5397\dot{3}$	0·8773559
$NH_4.H_2C_6H_5O_7$,		$6{\cdot}9709\dot{3}$	0·8432909
$K_3C_6H_5O_7 + H_2O$,		$10{\cdot}8168\dot{6}$	1·0341014
$(Na_3C_6H_5O_7)_2 + 11H_2O$,		$11{\cdot}9092\dot{6}$	1·0758850
$Li_3C_6H_5O_7 + 4H_2O$,		$9{\cdot}4064\dot{6}$	0·9734265
$Ba_3(C_6H_5O_7)_2 + 7H_2O$,		15·2732	1·1839300
C_6H_5COOH,		12·2048	1·0865307
$C_6H_5COONH_4$,		13·9112	1·1433646
$C_6H_5COOK + 3H_2O$,		21·4238	1·3308965
$C_6H_4OHCOOH$,		13·048	1·1155439
$C_6H_4OHCOONH_4$,		15·5112	1·1906454
$(C_6H_4OHCOOK)_2 + H_2O$,		18·5098	1·2674017
$C_6H_4OHCOONa + H_2O$,		17·8106	1·2506785
$C_6H_4OHCOOBiO$,		36·154	1·5581564
$C_6H_4OHCOOBiO + H_2O$,		37·9556	1·5792759
Salicylic acid and salicylates—			
$C_6H_4(OH)COOH$,	By iodometric methods, $I \equiv \frac{1}{6}C_6H_4OHCOOH$.	$2{\cdot}174\dot{6}$	0·3373926
$C_6H_4OHCOONH_4$,		2·5852	0·4124941
$(C_6H_4OHCOOK)_2 + H_2O$,		$3{\cdot}0849\dot{6}$	0·4892501

TABLE LXXVB (3).—*continued.*

Formula of Substance to be estimated.	Method of Estimation, etc.	Weight in Mgms. of Substance =1 c.cm. $\frac{N}{10}$ Solution.	Logarithm.
Salicylic acid and salicylates—			
$(C_6H_4OHCOOK)_2+H_2O$.		3·08496	0·4892504
$C_6H_4OHCOONa+H_2O$, .		2·96843	0·4725272
$C_6H_4OHCOOBiO$, . .		6·0256	0·7800051
$C_6H_4OHCOOBiO+H_2O$,		6·32593	0·8011246
Carbon disulphide and thiocarbonates—			
CS_2, ...	Absorb in alcoholic potash, neutralise or slightly acidulate with acetic acid, and all the CS_2 will now be found as C_2H_5OCSSH titrate with iodine solution. $I \equiv CS_2$.	7·612	0·8814988
K_2CS_3, ...		18·702	1·2718881
Na_2CS_3, ...		15·482	1·1898271
$(CH_3)_2CS_3$, . . .		13·8768	1·1422893
$(C_2H_5)_2CS_3$, . . .		16·68	1·2221960
$C_2H_5KCS_3$, . . .		17·691	1·2477524
Phenols, etc.—			
C_6H_5OH, ...	Precipitate phenols from aqueous or dilute alcoholic solutions by excess of bromine (total quantity known), and estimate excess of Br by iodometric methods. $Br \equiv I \equiv \frac{1}{6}C_6H_5OH$, etc.	1·56743	0·1951983
C_6H_5OK, ...		2·20316	0·3430473
C_6H_5ONa, ...		1·93483	0·2866435
$C_6H_4CH_3OH$, . . .		1·80106	0·2555298
$C_{10}H_{13}OH$, . . .		2·50186	0·3982641
$C_6H_4(OH)_2$, . . .		1·83413	0·2634309
$C_6H_3CH_3(OH)_2$, . .		2·06773	0·3154944

TABLE LXXVB (4).—**Organic Substances containing Nitrogen.**

Method of Estimation. Convert the nitrogen into ammonia and titrate against $\frac{N}{10}$ acid. Many of the mononitrogenous bases can be estimated also by direct titration against $\frac{N}{10}$ acid: with such bases the factors given are applicable to either method.

Formula of Substance to be estimated.	Weight in mgms of Substance ≡1 cm³. $\frac{N}{10}$ Solution.	Logarithm.	Formula of Substance to be estimated.	Weight in mgms. of Substance ≡1 cm³. $\frac{N}{10}$ Solution.	Logarithm.
Bases NC_nH_{2n+3}—			Bases NC_nH_{2n+3}—		
NCH_5, ...	3·108	0·4924810	$NC_{13}H_{29}$, . .	19·9272	1·2994463
NC_2H_7, ...	4·5096	0·6541380	$NC_{14}H_{31}$, . .	21·3288	1·3289664
NC_3H_9, ...	5·9112	0·7716757	$NC_{15}H_{33}$, . .	22·7304	1·3566070
NC_4H_{11}, . . .	7·3128	0·8640837	$NC_{16}H_{35}$, . .	24·132	1·3825933
NC_5H_{13}, . . .	8·7144	0·9402375	$NC_{18}H_{39}$, . .	26·9352	1·4303202
NC_6H_{15}, . . .	10·116	1·0050088	$NC_{20}H_{43}$, . .	29·7384	1·4733162
NC_7H_{17}, . . .	11·5176	1·0613622	$NC_{24}H_{51}$, . .	35·3448	1·5483255
NC_8H_{19}, . . .	12·9192	1·1112356	Bases NC_nH_{2n+1}—		
NC_9H_{21}, . . .	14·3208	1·1559672	NC_2H_5, . . .	4·308	0·6342757
$NC_{10}H_{23}$, . . .	15·7224	1·1965188	NC_3H_7, . . .	5·7096	0·7566057
$NC_{12}H_{27}$, . . .	18·5256	1·2677722	NC_4H_9, . . .	7·1112	0·8519429

TABLE LXXVB (4).—*continued.*

Formula of Substance to be estimated.	Weight in mgms. of Substance ≡1 cm³. $\frac{N}{10}$ Solution.	Logarithm.
Bases NC_nH_{2n+1}—		
NC_5H_{11}, . .	8·5128	0·9300724
NC_6H_{13}, . .	9·9144	0·9962664
NC_7H_{15}, . .	11·316	1·0536929
NC_8H_{17}, . .	12·7176	1·1044052
NC_9H_{19}, . .	14·1192	1·1498100
$NC_{10}H_{21}$, . .	15·5208	1·1909141
Bases NC_nH_{2n-1}—		
NC_2H_3, . . .	4·1064	0·6134613
NC_3H_5, . . .	5·508	0·7409939
NC_4H_7, . . .	6·9096	0·8394529
NC_7H_{13}, . .	11·1144	1·0458860
NC_8H_{15}, . .	12·516	1·0974656
$NC_{10}H_{19}$, . .	15·3192	1·1852304
Bases NC_nH_{2n-3}—		
NC_4H_5, . . .	6·7080	0·8265931
NC_5H_7, . . .	8·1096	0·9089994
NC_6H_9, . . .	9·5112	0·9782353
NC_7H_{11}, . .	10·9128	1·0379362
NC_8H_{13}, . .	12·3144	1·0904132
NC_9H_{15}, . .	13·7160	1·1372275
$NC_{10}H_{17}$, . .	15·1176	1·1794828
Bases NC_nH_{2n-5}—		
NC_5H_5, . . .	7·9080	0·8980667
NC_6H_7, . . .	9·3096	0·9689310
NC_7H_9, . . .	10·7112	1·0298381
NC_8H_{11}, . .	12·1128	1·0832445
NC_9H_{13}, . .	13·5144	1·1307968
$NC_{10}H_{15}$, . .	14·9160	1·1736524
$NC_{11}H_{17}$, . .	16·3176	1·2126563
$NC_{12}H_{19}$, . .	17·7192	1·2484441
$NC_{13}H_{21}$, . .	19·1208	1·2816059
$NC_{14}H_{23}$, . .	20·5224	1·2122282
Bases NC_nH_{2n-7}—		
NC_7H_7, . . .	10·5096	1·0215862
NC_8H_9, . . .	11·9112	1·0759555
NC_9H_{11}, . .	13·3128	1·1242694
$NC_{10}H_{13}$, . .	14·7144	1·1677426
$NC_{11}H_{15}$, . .	16·1160	1·2072573
$NC_{12}H_{17}$, . .	17·5176	1·2434746
$NC_{13}H_{19}$, . .	18·9192	1·2769028
$NC_{14}H_{21}$, . .	20·3208	1·3079408
Bases NC_nH_{2n-9}—		
NC_6H_3, . . .	8·9064	0·9497022
NC_7H_5, . . .	10·3080	1·0121744
NC_8H_7, . . .	11·7096	1·0685421
NC_9H_9, . . .	13·1112	1·1176424
$NC_{10}H_{11}$, . .	14·5128	1·1617512
$NC_{11}H_{13}$, . .	15·9144	1·2017903
$NC_{12}H_{15}$, . .	17·3160	1·2384476
$NC_{13}H_{17}$, . .	18·7176	1·2722501
$NC_{14}H_{19}$, . .	20·1192	1·3036107
$NC_{16}H_{23}$, . .	22·9224	1·3602601
Bases NC_nH_{2n-11}—		
NC_8H_5, . . .	11·5080	1·0609999
NC_9H_7, . . .	12·9096	1·1109126
Bases NC_nH_{2n-11}—		
$NC_{10}H_9$, . .	14·3112	1·155676
$NC_{11}H_{11}$, . .	15·7128	1·196253
$NC_{12}H_{13}$, . .	17·1144	1·233361
$NC_{13}H_{15}$, . .	18·5160	1·267547
$NC_{14}H_{17}$, . .	19·9176	1·299237
Bases NC_nH_{2n-13}—		
NC_9H_5, . . .	12·7080	1·104077
$NC_{11}H_9$, . .	15·5112	1·190645
$NC_{12}H_{11}$, . .	16·9128	1·228215
$NC_{13}H_{13}$, . .	18·3144	1·262792
$NC_{14}H_{15}$, . .	19·7160	1·294818
$NC_{15}H_{17}$, . .	21·1176	1·324644
Bases NC_nH_{2n-15}—		
$NC_{12}H_9$, . .	16·7112	1·223007
$NC_{13}H_{11}$, . .	18·1128	1·257985
$NC_{14}H_{13}$, . .	19·5144	1·290355
$NC_{15}H_{15}$, . .	20·9160	1·320478
$NC_{16}H_{17}$, . .	22·3176	1·348647
$NC_{17}H_{19}$, . .	23·7192	1·375100
Bases NC_nH_{2n-17}—		
$NC_{13}H_9$, . .	17·9112	1·253124
$NC_{14}H_{11}$, . .	19·3128	1·285845
$NC_{15}H_{13}$, . .	20·7144	1·316272
$NC_{16}H_{15}$, . .	22·1160	1·344706
$NC_{17}H_{17}$, . .	23·5176	1·371393
Bases NC_nH_{2n-19}—		
$NC_{13}H_7$, . .	17·7096	1·247208
$NC_{14}H_9$, . .	19·1112	1·281287
$NC_{15}H_{11}$, . .	20·5128	1·312025
$NC_{16}H_{13}$, . .	21·9144	1·340723
$NC_{17}H_{15}$, . .	23·3160	1·367654
$NC_{18}H_{17}$, . .	24·7176	1·393006
Bases NC_nH_{2n-21}—		
$NC_{16}H_{11}$, . .	21·7128	1·336715
$NC_{17}H_{13}$, . .	23·1144	1·363882
$NC_{18}H_{15}$, . .	24·5160	1·389449
$NC_{19}H_{17}$, . .	25·9176	1·413594
$NC_{21}H_{21}$, . .	28·7208	1·458196
Bases NC_nH_{2n-23}—		
$NC_{16}H_9$, . .	21·5112	1·332664
$NC_{17}H_{11}$, . .	22·9128	1·360078
$NC_{18}H_{13}$, . .	24·3144	1·385863
$NC_{19}H_{15}$, . .	25·7160	1·410203
$NC_{21}H_{19}$, . .	28·5192	1·455137
Bases NC_nH_{2n-25}—		
$NC_{17}H_9$, . .	22·7112	1·356240
$NC_{19}H_{13}$, . .	25·5144	1·406785
$NC_{20}H_{15}$, . .	26·9160	1·430010
$NC_{21}H_{17}$, . .	28·3176	1·452056
Bases NC_nH_{2n-27}—		
$NC_{19}H_{11}$, . .	25·3128	1·403340
$NC_{20}H_{13}$, . .	26·7144	1·426745
$NC_{21}H_{15}$, . .	28·1160	1·448953
$NC_{22}H_{17}$, . .	29·5176	1·470081

TABLE LXXVB (4).—*continued.*

Formula of Substance to be estimated.	Weight in mgms. of Substance ≡1 cm³. $\frac{N}{10}$ Solution.	Logarithm.
Substances with 1 atom of nitrogen in each molecule—		
$NC_{17}H_{17}O_2$,	26·7176	1·4267974
$NC_{16}H_{21}O_3$,	27·5208	1·4396610
$NC_{17}H_{19}O_3$,	28·5192	1·4551373
$NC_{17}H_{23}O_3$,	28·9224	1·4612343
$NC_{18}H_{21}O_3$,	29·9208	1·4759732
$NC_{19}H_{21}O_3$,	31·1208	1·4930507
$NC_{17}H_{21}O_4$,	30·3208	1·4817406
$NC_{18}H_{23}O_4$,	31·7224	1·5013661
$NC_{20}H_{17}O_4$,	33·5176	1·5252729
$NC_{20}H_{21}O_4$,	33·9208	1·5304660
$NC_{20}H_{28}O_5$,	36·2264	1·5590252
$NC_{22}H_{25}O_6$,	39·9240	1·6012340
$NC_{22}H_{23}O_7$,	41·3224	1·6161855
$NC_{23}H_{29}O_9$,	46·3272	1·6658361
$NC_{20}H_{39}O_{10}$,	44·3272	1·6466801
$NC_{37}H_{53}O_{11}$,	68·7464	1·8372499
$NC_{33}H_{45}O_{12}$,	64·7400	1·8111727
Substances with 2 atoms of nitrogen in each molecule—		
N_2CH_4,	2·2056	0·3435268
N_2CH_6,	2·3064	0·3629346
$N_2C_2H_6$,	2·9064	0·4633554
$N_2C_2H_8$,	3·0072	0·4781623
$N_2C_3H_4$,	3·4056	0·5321936
$N_2C_3H_8$,	3·6072	0·5571702
$N_2C_3H_{10}$,	3·7080	0·5691397
$N_2C_4H_{10}$,	4·3080	0·6342757
$N_2C_4H_{12}$,	4·4088	0·6443204
$N_2C_5H_{12}$,	5·0088	0·6997337
$N_2C_5H_{14}$,	5·1096	0·7083869
$N_2C_6H_8$,	5·4072	0·7329724
$N_2C_6H_{12}$,	5·6088	0·7488700
$N_2C_6H_{14}$,	5·7096	0·7566057
$N_2C_6H_{16}$,	5·8104	0·7642060
$N_2C_7H_{10}$,	6·1080	0·7858990
$N_2C_8H_{12}$,	6·8088	0·8330706
$N_2C_8H_{20}$,	7·2120	0·8580557
$N_2C_9H_{18}$,	7·7112	0·8871220
$N_2C_9H_{22}$,	7·9128	0·8983302
$N_2C_{10}H_8$,	7·8072	0·8924953
$N_2C_{10}H_{14}$,	8·1096	0·9089994
$N_2C_{10}H_{24}$,	8·6136	0·9351847
$N_2C_{12}H_{12}$,	9·2088	0·9642030
$N_2C_{12}H_{28}$,	10·0152	1·0006596
$N_2C_{13}H_{16}$,	10·0104	1·0004514
$N_2C_{13}H_{30}$,	10·7160	1·0300327
$N_2C_{14}H_{16}$,	10·6104	1·0257318
$N_2C_{14}H_{24}$,	11·0136	1·0419293
$N_2C_{15}H_{22}$,	11·5128	1·0611810
$N_2C_{17}H_{24}$,	12·8136	1·1076712
$N_2C_{17}H_{38}$,	13·5192	1·1309510
$N_2C_{21}H_{20}$,	15·0120	1·1764386
$N_2C_{26}H_{22}$,	18·1128	1·2579856
$N_2C_{38}H_{30}$,	24·5160	1·3894496

Formula of Substance to be estimated.	Weight in mgms. of Substance ≡1 cm³. $\frac{N}{10}$ Solution.	Logarithm.
Substances with 2 atoms of nitrogen in each molecule—		
$N_2C_{11}H_{16}O_2$,	10·4104	1·0174674
$N_2C_{10}H_{22}O$,	14·7128	1·1167953
$N_2C_{20}H_{24}O$,	15·4136	1·1879041
$N_2C_{20}H_{24}O + 3H_2O$,	18·1160	1·2580623
$N_2C_{20}H_{24}O_2$,	16·2136	1·2098795
$2N_2C_{20}H_{24}O_2 + 5H_2O$,	18·4656	1·2663634
$N_2C_{21}H_{22}O_2$,	16·7128	1·2230388
$N_2C_{22}H_{30}O_2$,	17·7160	1·2483657
$N_2C_{22}H_{38}O_4$,	19·7192	1·2948893
$N_2C_{23}H_{26}O_4$,	19·7144	1·2947836
$N_2C_{23}H_{26}O_4 + 4H_2O$,	23·3176	1·3676839
$N_2C_{24}H_{28}O_4$,	20·4152	1·3099536
$N_2C_{30}H_{40}O_5$,	25·4200	1·4051755
$N_3C_{30}H_{44}O_4$,	24·8216	1·3948298
$N_2C_{50}H_{52}O_3$,	36·4248	1·4613972
Substances with 3 atoms of nitrogen in each molecule—		
N_3CH_5,	1·9720	0·2949069
$N_3C_2H_3$,	2·3048	0·3626332
$N_3C_2H_7$,	2·4392	0·3872474
$N_3C_3H_5$,	2·7720	0·4427932
$N_3C_4H_3$,	3·1048	0·4920336
$N_3C_4H_5$,	3·1720	0·5013332
$N_3C_4H_7$,	3·2392	0·5104378
$N_3C_4H_9$,	3·3064	0·5193554
$N_3C_4H_{11}$,	3·3736	0·5280936
$N_3C_4H_{13}$,	3·4408	0·5366594
$N_3C_5H_9$,	3·7064	0·5689523
$N_3C_6H_5$,	3·9720	0·5990092
$N_3C_6H_7$,	4·0392	0·6062954
$N_3C_6H_9$,	4·1064	0·6134613
$N_3C_7H_7$,	4·4392	0·6473047
$N_3C_7H_9$,	4·5064	0·6538297
$N_3C_7H_{11}$,	4·5736	0·6602582
$N_3C_8H_7$,	4·8392	0·6847736
$N_3C_8H_9$,	4·9064	0·6907630
$N_3C_8H_{13}$,	5·0408	0·7024995
$N_3C_9H_7$,	5·2392	0·7192650
$N_3C_9H_9$,	5·3064	0·7248000
$N_3C_9H_{11}$,	5·3736	0·7302653
$N_3C_9H_{13}$,	5·4408	0·7356628
$N_3C_9H_{15}$,	5·5080	0·7409939
$N_3C_{10}H_7$,	5·6392	0·7512175
$N_3C_{10}H_9$,	5·7064	0·7563622
$N_3C_{10}H_{11}$.	5·7736	0·7614467
$N_3C_{10}H_{13}$,	5·8408	0·7664723
$N_3N_{10}H_{15}$,	5·9080	0·7714405
$N_3C_{10}H_{17}$,	5·9752	0·7763524
$N_3C_{10}H_{21}$,	6·1096	0·7860128
$N_3C_{12}H_{11}$,	6·5736	0·8178033
$N_3C_{19}H_{27}$,	9·9112	0·9961262
$N_3C_{23}H_{23}$,	11·3768	1·0560202
$N_3C_5H_9O_2$,	4·77306	0·6787975
$N_3C_6H_7O_3$,	5·6392	0·7512175

TABLE LXXVB (4).—*continued.*

Formula of Substance to be estimated.	Weight in mgms. of Substance $=1$ cm³. $\frac{N}{10}$ Solution.	Logarithm.
Substances with 3 atoms of nitrogen in each molecule—		
$N_3C_6H_{11}O_2$,	5·2402$\dot{6}$	0·7193534
$N_3C_7H_7O_5$,	7·1058$\dot{6}$	0·8516170
$N_3C_8H_9O_5$,	7·5730$\dot{6}$	0·8792717
$N_3C_{10}H_{15}O_7$,	9·6413$\dot{3}$	0·9841371
$N_3C_{10}H_{17}O_8$,	10·2418$\dot{6}$	1·0103791
$N_3C_{15}H_{21}O_2$,	9·1762$\dot{6}$	0·9626660
Substances with 4 atoms of nitrogen in each molecule—		
N_4CH_2,	1·7544	0·2441286
N_4CH_4,	1·8048	0·2564291
N_4CH_6,	1·8552	0·2683907
N_4CH_8,	1·9056	0·2800317
$N_4C_2H_4$,	2·1048	0·3232108
$N_4C_2H_6$,	2·1552	0·3334876
$N_4C_3H_4$,	2·4048	0·3810790
$N_4C_3H_6$,	2·4552	0·3900869
$N_4C_4H_6$,	2·7552	0·1401531
$N_4C_4H_{10}$,	2·8560	0·4557582
$N_4C_4H_{12}$,	2·9064	0·4633554
$N_4C_5H_4$,	3·0048	0·4778156
$N_4C_5H_8$,	3·1056	0·4921455
$N_4C_5H_{10}$,	3·1560	0·4991370
$N_4C_5H_{12}$,	3·2064	0·5060177
$N_4C_6H_6$,	3·3552	0·5257184
$N_4C_6H_8$,	3·4056	0·5321936
$N_4C_6H_{10}$,	3·4560	0·5385737
$N_4C_6H_{12}$,	3·5064	0·5448615
$N_4C_6H_{16}$,	3·6072	0·5571702
$N_4C_6H_{18}$,	3·6576	0·5631962
$N_4C_7H_6$,	3·6552	0·5629111
$N_4C_7H_8$,	3·7056	0·5688585
$N_4C_7H_{10}$,	3·7560	0·5747256
$N_4C_7H_{12}$,	3·8064	0·5805144
$N_4C_8H_6$,	3·9552	0·5971684
$N_4C_8H_8$,	4·0056	0·6026676
$N_4C_8H_{10}$,	4·0560	0·6080979
$N_4C_8H_{12}$,	4·1064	0·6134613
$N_4C_8H_{14}$,	4·1568	0·6187591
$N_4C_9H_8$,	4·3056	0·6340337
$N_4C_9H_{10}$,	4·3560	0·6390879
$N_4C_9H_{12}$,	4·4064	0·6440839
$N_4C_9H_{16}$,	4·5072	0·6539068
$N_4C_{10}H_6$,	4·5552	0·6585074
$N_4C_{10}H_8$,	4·6056	0·6632862
$N_4C_{10}H_{10}$,	4·6560	0·6680130
$N_4C_{10}H_{12}$,	4·7064	0·6726888
$N_4C_{10}H_{14}$,	4·7568	0·6773149
$N_4C_{10}H_{20}$,	4·9080	0·6909046
$N_4C_5H_5O$,	3·4300	0·5352941
$N_4C_5H_8O$,	3·5056	0·5447624
$N_4C_5H_{10}O$,	3·5560	0·5509618
$N_4C_5H_4O_2$,	3·8048	0·5803318
$N_4C_6H_4O_2$,	4·1048	0·6132920
$N_4C_6H_{14}O_2$,	4·3568	0·6391676

Formula of Substance to be estimated.	Weight in mgms. of Substance $\equiv 1$ cm³. $\frac{10}{N}$ Solution.	Logarithm.
Substances with 4 atoms of nitrogen in each molecule—		
$N_4C_7H_{12}O$,	4·2064	0·6239106
$N_4C_7H_8O_2$,	4·5056	0·6537526
$N_4C_7H_8O_3$,	4·9056	0·6906921
$N_4C_7H_{10}O_3$,	4·9560	0·6951313
$N_4C_7H_{10}O_4$,	5·3560	0·7288406
$N_4C_8H_{10}O_2$,	4·8560	0·6862787
$N_4C_8H_{10}O_3$,	5·2560	0·7206554
$N_4C_8H_{12}O_3$,	5·3064	0·7248000
$N_4C_9H_{12}O_2$,	5·2064	0·7165375
$N_4C_9H_{14}O_3$,	5·6568	0·7525708
$N_4C_9H_{16}O_4$,	6·1072	0·7858421
$N_4C_{10}H_4O_2$,	5·3048	0·7246690
Substancss with 5 or more atoms of nitrogen in each molecule—		
$N_5C_2H_5$,	1·98480	0·2977168
$N_5C_2H_7$,	2·02512	0·3064508
$N_5C_3H_5$,	2·22480	0·3472910
$N_5C_3H_7$,	2·26512	0·3550912
$N_5C_3H_9$,	2·30544	0·3627538
$N_5C_4H_7$,	2·50512	0·3988286
$N_5C_5H_5$,	2·70480	0·4321352
$N_5C_5H_9$,	2·78544	0·4448938
$N_5C_5H_{11}$,	2·82576	0·4511353
$N_5C_6H_{11}$,	3·06576	0·4865382
$N_5C_7H_7$,	3·22512	0·5085459
$N_5C_7H_{13}$,	3·34608	0·5245363
$N_5C_8H_9$,	3·50544	0·5447426
$N_5C_8H_{15}$,	3·62640	0·5594757
$N_5C_9H_{17}$,	3·90672	0·5918123
$N_5C_{10}H_9$,	3·98544	0·6004763
$N_5C_4H_5O$,	2·78480	0·4447940
$N_5C_5H_5O$,	3·02480	0·4806967
N_6CH_4,	1·6712	0·2230284
N_6CH_6,	1·7048	0·2316734
$N_6C_2H_2$,	1·8376	0·2642510
$N_6C_2H_6$,	1·9048	0·2798494
$N_6C_2H_8$,	1·9384	0·2874434
$N_6C_3H_6$,	2·1048	0·3232108
$N_6C_4H_4$,	2·2712	0·3562554
$N_6C_5H_6$,	2·5048	0·3987731
$N_6C_6H_4$,	2·6712	0·4267064
$N_6C_6H_8$,	2·7384	0·4374969
$N_6C_8H_{12}$,	3·2056	0·5059093
$N_6C_9H_{12}$,	3·4056	0·5447624
$N_6C_{10}H_8$,	3·5384	0·5488069
$N_6C_{10}H_{16}$,	3·6728	0·5649973
$N_7C_8H_{19}O_4$,	3·9633	0·5980585
$N_8C_{16}H_{20}O_8$,	5·6560	0·7525094
$N_8C_{16}H_{26}O_{11}$,	6·3316	0·8015135
$N_9C_{10}H_{13}O_2$,	3·2384$\dot{8}$	0·5103425
$N_9H_{16}H_{31}O_3$,	4·4178$\dot{6}$	0·6452126
$N_{10}C_{11}H_{21}O_5$,	3·76592	0·5758711
$N_{11}C_{12}H_{25}O_5$,	3·669$\dot{4}\dot{5}$	0·5646015
$N_{11}C_{28}H_{51}O_{21}$,	7·980$\dot{4}3\dot{6}$	0·9020266

LXXVB (5).—Direct Titration of Acids and Acidic Substances with various Indicators.

Substance. Name.	Formula.	Methyl Orange. Factor.	Methyl Orange. Logarithm.	Phenolphthaleïn. Factor.	Phenolphthaleïn. Logarithm.	Poirrier's Blue. Factor.	Poirrier's Blue. Logarithm.
Sulphuric acid, . .	H_2SO_4	4·9038	0·6929174	4·9038	0·6929174	4·9038	0·6929174
Thiosulphuric ,, . .	$H_2S_2O_3$	5·7068	0·7563927	5·7068	0·7563927	5·7068	0·7563927
Sulphurous ,, . .	H_2SO_3	8·2076	0·9142162	4·1038	0·6131862	4·1038	0·6131862
Phosphoric ,, . .	H_3PO_4	9·8024	0·9913324	4·9012	0·6903024	4·9012	0·6903024
Arsenic ,, . .	H_3AsO_4	14·2024	1·1523617	7·1012	0·8513317	7·1012	0·8513317
Chromic ,, . .	H_2CrO_4	11·8116	1·0723087	5·9058	0·7712787	5·9058	0·7712787
		Heli	anthin.				
Formic ,, . .	CH_2O_2	×		4·6016	0·6629089	4·6016	0·6629089
Acetic ,, . .	$C_2H_4O_2$	×		6·0032	0·7783828	6·0032	0·7783828
Propionic ,, . .	$C_3H_6O_2$	×		7·4048	0·8695133	7·4048	0·8695133
Butyric ,, . .	$C_4H_8O_2$	×		8·8064	0·9447984	8·8064	0·9447984
Valeric ,, . .	$C_5H_{10}O_2$	×		10·2080	1·0089407	10·2080	1·0089407
Caproic ,, . .	$C_6H_{12}O_2$	×		11·6096	1·0648174	11·6096	1·0648174
Glycollic ,, . .	$C_2H_4O_3$	×		7·6032	0·8809964	7·6032	0·8809964
Pyruvic ,, . .	$C_3H_4O_3$	8·8032	0·9446406	8·8032	0·9446406	8·8032	0·9446406
Lactic ,, . .	$C_3H_6O_3$	×		9·0048	0·9544741	9·0048	0·9544741
Levulic ,, . .	$C_5H_8O_3$	11·6064	1·0646976	11·6064	1·0646976	11·6064	1·0646976
Benzoic ,, . .	$C_7H_6O_2$	×		12·2048	1·0865307	12·2048	1·0865307
Brombenzoic (o. m. & p.) acid,	$C_7H_5BrO_2$	×		20·1000	1·3031961	20·1000	1·3031961
Nitrobenzoic (o. m. & p.) ,,	$C_7H_5NO_4$	×		16·7080	1·2229245	16·7080	1·2229245
Oxybenzoic (o.) ,,	$C_7H_6O_3$	13·8048	1·1400301	13·8048	1·1400301	13·8048	1·1400301
Oxybenzoic (m. & p.) ,,	$C_7H_6O_3$	×		13·8048	1·1400301	6·9024	0·8390001
Protocatechuic acid, . .	$C_7H_6O_4$	×		15·4048	1·1876561	7·7024	0·8866261
Vanillic ,, . .	$C_8H_8O_4$	×		16·8064	1·2254747	8·4032	0·9244447
Oxalic ,, (anhydr.),	$C_2H_2O_4$	×		4·5008	0·6532897	4·5008	0·6532897
Oxalic ,, (cryst.),	$C_2H_6O_6$	×		6·3024	0·7995060	6·3024	0·799506
Malonic ,, . .	$C_3H_4O_4$	×		5·2016	0·7161370	5·2016	0·7161370
Succinic ,, . .	$C_4H_6O_4$	×		5·9024	0·7710286	5·9024	0·7710286
Sebacic ,, . .	$C_{10}H_{18}O_4$	×		10·1072	1·0046309	10·1072	1·0046309
Maleic ,, . .	$C_4H_4O_4$	5·8016	0·7635478	5·8016	0·7635478	?	
Fumaric ,, . .	$C_4H_4O_4$	5·8016	0·7635478	5·8016	0·7635478	?	
Tartaric ,, . .	$C_4H_6O_6$	?		7·5024	0·8752002	7·5024	0·8752002
Meconic ,, (anhydr.),	$C_7H_4O_7$	10·0016	1·0000694	10·0016	1·0000694	6·66773	0·8239781
Meconic ,, (cryst.),	$C_7H_{10}O_{10}$	12·7040	1·1039405	12·7040	1·1039405	8·4693	0·9278492
Phthallic ,, . .	$C_8H_6O_4$	×		8·3024	0·9192037	8·3024	0·9192037
Tricarballylic ,, . .	$C_6H_8O_6$	?		5·8688	0·7685493	?	
Citric ,, (anhydr.),	$C_6H_8O_7$	?		6·40213	0·8063246	?	
Citric ,, (cryst.),	$C_6H_{10}O_8$	?		7·0026	0·8452634	?	
Mellitic ,, . .	$C_{12}H_6O_{12}$	11·4016	1·0569658	5·7008	0·7559358	5·7008	0·7559358
Trichloracetic ,, . .	$C_2HCl_3O_2$	16·3358	1·2131404	16·3358	1·2131404	?	
Dibromsuccinic ,, . .	$C_4H_4Br_2O_4$	13·7976	1·1398035	13·7976	1·1398035	?	
Iso-ethionic ,, . .	$C_2H_6SO_4$	12·6108	1·1007426	12·6108	1·1007426	12·6108	1·100742
Sulphanilic ,, . .	$C_6H_7NSO_3$	17·3156	1·2384376	17·3156	1·2384376	17·3156	1·238437
Methyl-phosphoric acid, .	CH_5PO_4	11·2040	1·0493731	5·6020	0·7483431	?	
Dimethyl-phosphoric ,, .	$C_2H_7PO_4$	12·6056	1·1005635	12·6056	1·1005635	?	
Ethyl-phosphoric ,, .	$C_2H_7PO_4$	12·6056	1·1005635	6·3028	0·7995335	?	
Diethyl-phosphoric ,, .	$C_4H_{11}PO_4$	15·4088	1·1877689	15·4088	1·1877689	?	
Propyl-phosphoric ,, .	$C_3H_9PO_4$	14·0072	1·1463513	7·0036	0·8453213	?	
Isoamyl-phosphoric ,, .	$C_5H_{13}PO_4$	16·8104	1·2255780	8·4052	0·9245480	?	
Di-isoamyl-phosphoric ,, .	$C_{10}H_{23}PO_4$	23·8184	1·3769126	23·8184	1·3769126	?	
Cacodylic ,, .	$C_2H_7AsO_2$	×		13·8056	1·1400553	?	
Phenol, ...	C_6H_6O	×		×		9·4048	0·973349
Picric acid, ...	$C_6H_3N_3O_7$	22·9144	1·3601085	22·9144	1·3601085	22·9144	1·360108
Chloral hydrate, . . .	$C_2H_3Cl_3O_2$	?		?		16·5374	1·218467
Chloral alcoholate, . . .	$C_4H_7Cl_3O_2$	?		?		19·3406	1·286469
Bromal, ...	C_2HBr_3O	?		?		28·0888	1·448533

TABLE LXXVB (5).—*continued.*

Substance. Name.	Formula.	Helianthin. Factor.	Helianthin. Logarithm.	Phenolphthalein. Factor.	Phenolphthalein. Logarithm.	Poirrier's Blue. Factor.	Poirrier's Blue. Logarithm.
Salicyl aldehyde, ...	$C_7H_6O_2$	×		12·2048	1·0865307	12·2048	1·0865307
Vanillin, ...	$C_8H_8O_3$	×		15·2064	1·1820264	15·2064	1·1820264
Piperonal, ...	$C_8H_6O_3$	×		15·0048	1·1762303	15·0048	1·1762303
Acetylacetone, ...	$C_5H_8O_2$	?		?		10·0064	1·0002779
Monochloracetone, . . .	C_3H_5ClO	×		9·2490	0·9660948	9·2490	0·9660948
Monobromacetophenone, .	C_8H_7BrO	×		19·9016	1·2988880	19·9016	1·2988880

× Not applicable. ? Not very reliable.

LXXVB (6).—Direct Titration of Basic Substances with various Indicators.

Substance. Name.	Formula.	Solvent.	Indicators.	Factor.	Logarithm.
Methylamine, ...	NH_2CH_3	Water	Helianthin (H.) or Phenolphthalein (Ph.)	3·1080	0·4924810
Dimethylamine, ...	$NH(CH_3)_2$	,,		4·5096	0·6541380
Ethylamine, ...	$NH_2C_2H_5$	,,			
Trimethylamine, ...	$N(CH_3)_3$	,,		5·9112	0·7716757
Propylamine, ...	$NH_2C_3H_7$	,,			
Diethylamine, ...	$NH(C_2H_5)_2$	,,		7·3128	0·8640837
Butylamine (normal), . .	$NH_2C_4H_9$	Alcohol (dil.)			
,, (iso), ...	$NH_2C_4H_9$	Water			
Tetramethylammonium hydrate,	$N(CH_3)_4OH$	,,		9·1144	0·9597281
,, (cryst.), .	$N(CH_3)_4OH \cdot H_2O$	,,		10·9160	1·0380635
Pyridine, ...	$N{<}^{CH:CH}_{CH:CH}{>}CH$	,,	Methyl orange (O.)	7·9080	0·8980667
Amylamine, ...	$NH_2C_5H_{11}$	,,	H. & Ph.	8·7144	0·9402375
Aniline, ...	$NH_2C_6H_5$	Alcohol (dil.)	O.	9·3096	0·9689310
Triethylamine, ...	$N(C_2H_5)_3$	Water	H. & Ph.	10·1160	1·0050088
Dipropylamine, ...	$NH(C_3H_7)_2$	,,	H. & Ph.		
Orthotoluidine, ...	$C_6H_4{<}^{(1)\ NH_2}_{(2)\ CH_3}$	Alcohol (dil.)	O.	10·7112	1·0298381
Paratoluidine, ...	$C_6H_4{<}^{(1)\ NH_2}_{(2)\ CH_3}$	Water	O.		
Dimethylaniline, ...	$N(CH_3)_2C_6H_5$	Alcohol (dil.)	O.	12·1128	1·0832445
Tetraethylammonium hydrate, .	$N(C_2H_5)_4OH$	Water	H. & Ph.	14·7208	1·1679314
,, (cryst.), .	$N(C_2H_5)_4OH \cdot H_2O$	,,	H. & Ph.	16·5224	1·2180731
Quinoline, ...	NC_9H_7	Alcohol (dil.)	O.	12·9096	1·1109128
Tripropylamine, ...	$N(C_3H_7)_3$	Water	H. & Ph.	14·3208	1·1559673
α-Naphthylamine, . . .	$NH_2C_{10}H_7$	Alcohol (dil.)	O.	14·3112	1·1556761
β-Naphthylamine, . . .					
Diamylamine, ...	$NH(C_5H_{11})_2$	,,	H. & Ph.	15·7224	1·1965188
Ethylenediamine, ...	$(NH_2)_2C_2H_4$	,,	Ph.	6·0144	0·7791923
Ethylenediamine, ...	$(NH_2)_2C_2H_4$	,,	O.	3·0072	0·4781623
Diethylenediamine, . . .	$(NH_2)_2(C_2H_3)_2$	,,	Ph.	8·6160	0·9353057
Diethylenediamine, . . .	$(NH_2)_2(C_2H_3)_2$	,,	O.	4·3080	0·6342757
p-Phenylenediamine, . . .	$(NH_2)_2C_6H_4$	,,	H.	10·8144	1·0340024
Phenylhydrazine, ...	$C_6H_5NH \cdot NH_2$	,,	H.		

LXXVB (7).—Estimation of some Isolated Alkaloids.

The alkaloid is treated with a known volume—somewhat in excess of what it requires to form a neutral salt—of N/50 acid; H_2SO_4 is best; and then the excess of acid is found by titrating with N/50 solution of NaOH or KOH.

The principal indicators are mentioned in the order of the reliability and sharpness of their indications.

Reference numbers to indicators—

1. Alkannin, $C_{15}H_{14}O_4$.
2. Azolithmin.
3. Cochineal.
4. Congo red, $C_{32}H_{22}N_6S_2O_6Na_2$.
5. Ethyl orange, $C_{16}H_{20}N_3SO_3$.
6. Hæmatoxyline, $C_{16}H_{14}O_6 + 3H_2O$.
7. Iodeosine, $C_{20}H_6O_5I_4K_2$.
8. Litmus.
9. Methyl orange, $C_{14}H_{16}N_3SO_3$.
10. Phenolphthalein, $C_{20}H_{14}O_4$.
11. Uranine, $C_{20}H_{10}O_5Na_2$.

Most alkaloids behave like monad radicles.

Alkaloid. Name.	Formula.	Indicators.	Factor =1 cm³. N/50.	Logarithm.
Aconitine,	$NC_{33}H_{45}O_{12}$	2, 3, 7, 6.	12·9480	1·1122027
Atropine,	$NC_{17}H_{23}O_3$	8, 11, 2, 7, 3, 5, 9, 6.	5·78448	0·7622643
Brucine,	$N_2C_{23}H_{26}O_4$	3, 2, 6.	7·88576	0·8968436
Brucine (cryst.),	$N_2C_{23}H_{34}O_8$	3, 2, 6.	9·32704	0·9697439
Cocaïne,	$NC_{17}H_{21}O_4$	8, 11, 6, 3.	6·06416	0·7827706
Codeïne,	$NC_{18}H_{21}O_3$	7, 8, 2, 11, 6, 3.	5·98416	0·7770032
Codeïne (cryst.),	$NC_{18}H_{23}O_4$	7, 8, 2, 11, 6, 3.	6·34448	0·8023961
Coniine,	NC_8H_{17}	7, 3, 2, 8, 5, 9, 11, 6, 4.	2·54352	0·4054352
Emetine,	$N_2C_{30}H_{40}O_5$	7, 3, 8, 2, 5, 9, 11, 6.	10·16800	1·0072355
Morphine,	$NC_{17}H_{19}O_3$	3, 8.	5·70384	0·7561673
Morphine (cryst.),	$NC_{17}H_{21}O_4$	3, 8.	6·06416	0·7827706
Narcotine,	$NC_{22}H_{23}O_7$	8.	8·26448	0·9172155
Nicotine,	$N_2C_{10}H_{14}$	8, 11, 3.	3·24384	0·5110594
Papaverine,	$NC_{20}H_{21}O_4$	8.	6·78416	0·6314960
Pelletierine,	$NC_8H_{15}O$	3, 11, 8.	2·82320	0·4507416
Quinine,	$N_2C_{20}H_{24}O_2$	2, 6, 11, 8.	3·08272	0·4889341
Quinine (cryst.),	$N_2C_{20}H_{30}O_5$	2, 6, 11, 8.	3·62320	0·5590923
Sparteïne,	$N_2C_{15}H_{16}$	6, 2, 10, 11, 1.	4·48416	0·6516811
Strychnine,	$N_2C_{21}H_{22}O_2$	2, 6.	6·68512	0·8251092
Thebaïne,	$NC_{19}H_{21}O_3$	7, 3, 11, 8.	6·22416	0·7940808
Veratrine,	$NC_{37}H_{53}O_{11}$	8, 7, 6, 3.	13·74928	0·1382799

TABLE LXXVB (8).—Volumetric Estimations of Organic Compounds.

Name of Substance.	Formula.	Method of Estimation.	Wt. in Mgms. of Substance≡ 1 cm³ $\frac{N}{10}$ Sol.	Logarithm.
Acetaldehyde,	CH_3CHO	Treat with excess of standard solution of alkali-bisulphite: estimate excess of bisulphite by iodine: $CH_3CHO \equiv 2I$	2·2016	0·3427384
		Reducing action on $AgNO_3$: $CH_3CHO + 2AgNO_3 + H_2O = CH_3COOH + 2Ag + 2HNO_3$	2·2016	0·3427384
		Aldehyde in ether precipitated as $CH_3.C.OH.H.NH_2$ by NH_3 solution, and excess of NH_3 estimated: $CH_3.CHO \equiv NH_3$	4·4032	0·6437684
Acetanilid,	$C_6H_5NH(CH_3CO)$	By bromination: $C_6H_5NH(CH_3CO) \equiv 2Br$	6·7556	0·8296639
Acetone,	CH_3COCH_3	Against iodine in dilute solution: $CH_3COCH_3 \equiv 6I$	0·96746	$\bar{1}$·9856360
Acetylene,	C_2H_2	Reduction of $AgNO_3$: $C_2H_2 + 3AgNO_3 = C_2Ag_2.AgNO_3 + HNO_3$	0·8672	$\bar{1}$·9381193
Acetylphenylhydrazine,	$C_6H_5NH.NH(CH_3CO)$	Against Br in conc. HCl solution: $C_6H_5NH.NH(CH_3CO) \equiv 4Br$	3·754	0·5744943
Acet-toluide (ortho & para),	$C_6H_4(CH_3).NH(CH_3CO)$	$C_9H_{11}ON \equiv 2Br$	7·4568	0·8725525
Allylalcohol,	$CH_2:CHCH_2OH$	$C_3H_6O \equiv 2Br$	2·9024	0·4627573
m-Amidophenol,	$C_6H_4(NH_2)OH$	$C_6H_7ON \equiv 6Br$	1·81826	0·2596575
Aniline,	$C_6H_5NH_2$	$C_6H_7N \equiv 6Br$	1·5516	0·1907798
		By di-azotising with excess of standard $NaNO_2$ solution ($C_6H_7N \equiv NaNO_2 \equiv O$): estimate excess of $NaNO_2$ by $\frac{N}{10}$ $KMnO_4$	4·6548	0·6679010
Antipyrin,	$C_{11}H_{12}N_2O$	By treating with excess of iodine solution: $C_{11}H_{12}N_2O \equiv 2I$	9·4088	0·9735342
Atropine,	$C_{17}H_{23}NO_3$	$C_{17}H_{23}NO_3 \equiv 8I$	3·6153	0·5581443
Benzidine,	$C_{12}H_{12}N_2$	$C_{12}H_{12}N_2 \equiv 8Br$	2·3022	0·3621430
Benzylhydrazine,	$C_6H_8N_2$	$C_6H_8N_2 \equiv 4I$	2·7036	0·4319424
Caffeine,	$C_8H_{10}N_4O_2$	In acid solutions of I and KI. 1 mol. caffeïne≡4I	4·8560	0·6862787
,, cryst,	$C_8H_{10}N_4O_2 + H_2O$		5·03064	0·7016232
Chloral hydrate.	$CCl_3CHO + H_2O$	$CCl_3CHO.H_2O + 2I + 2KOH = 2KI + 2H_2O + CO_2 + CHCl_3$	8·2687	0·9174372
Chloroform,	$CHCl_3$	$CHCl_3 + 4KOH = HCOOK + 3KCl + 2H_2O$	2·98395	0·4747916
Cholestrine,	$C_{26}H_{44}O$	$C_{26}H_{44}O + Br_2 = C_{26}H_{44}OBr_2$	18·6176	1·2699237
Cresol (o and p),	$C_6H_4.CH_3.OH$	$C_7H_8O \equiv 4Br$	2·7016	0·4316210
,, (m),	$C_6H_4CH_3.OH$	$C_7H_8O \equiv 6Br$	1·80106	0·2555297
Diamidostilbene,	$C_{14}H_{10}(NH_2)_2$	Diazotising: $C_{14}H_{14}N_2 \equiv 2NaNO_2 \equiv 2O$	5·2298	0·7184851
Dianisidine,	$(H_3CO)(NH_2):C_6H_3.C_6H_3:(NH_2)(OCH_3)$	Diazotising: $C_{14}H_{16}N_2O_2 \equiv 2NaNO_2 \equiv 2O$	6·1052	0·7856999
Diazoamidobenzol,	$C_6H_5N:N.NH.C_6H_5$	$C_{12}H_{11}N_3 \equiv 6Br$	3·2868	0·5167733
Diethylaniline.	$C_6H_5N(C_2H_5)_2$	$C_{10}H_{15}N \equiv 4Br$	3·7290	0·5715924

TABLE LXXVB (8).—*continued.*

Name of Substance.	Formula.	Method of Estimation.	Wt. in Mgms. of Substance≡ 1 cm³ $\frac{N}{10}$ Sol.	Logarithm.
Dimethylaniline, . .	$C_6H_5N(CH_3)_2$	$C_{18}H_{11}N \equiv 4Br$	3·0282	0·4811846
Emetine, . . .	$C_{28}H_{40}N_2O_5$ (?)	In acid solution of I and KI. 1 mol. emetine≡7I	6·92	0·8401061
,,	$C_{30}H_{40}N_2O_5$ (?)		7·26285	0·8611075
Ethylamine, . . .	$C_2H_5NH_2$	Diazotising : $C_2H_7N \equiv NaNO_2 \equiv O$	2·2548	0·3531080
Ethylaniline, . . .	$C_6H_5NHC_2H_5$	Diazotising : $C_8H_{11}N \equiv NaNO_2 \equiv O$	6·0564	0·7822146
		Bromination : $C_8H_{11}N \equiv 6Br$	2·0188	0·3050933
Ethyl-o-toluidine, . .	$C_6H_4(NHC_2H_5)(CH_3)$	$C_9H_{13}N \equiv 4Br$	3·3786	0·5287368
Formaldehyde, . .	HCHO	Treat with excess of NH_3 and estimate excess : $6HCHO + 4NH_3 = N_4(CH_2)_6 + 6H_2O$: with methyl orange, etc., $6CH_2O \equiv 3NH_3$	6·0032	0·7783828
		With phenolphthaleine $6CH_2O \equiv 4NH_3$	4·5024	0·6534441
		$CH_2O + I_2 + 3NaOH = HCOONa + 2NI + 2H_2O$	1·5008	0·1763228
		Against $KMnO_4$ in alkaline solution cold $CH_2O \equiv O$	1·5008	0·1763228
		boiling : $CH_2O \equiv 2O$	0·7504	$\bar{1}$·8752928
		Boiling for some time with known volume (excess) of ammoniacal $AgNO_3$ and estimating excess : $CH_2O + H_2O + 4AgNO_3 = 4Ag + 4HNO_3 + CO_2$	0·7504	$\bar{1}$·8752928
		Warm with excess of $AgNO_3\left(\frac{N}{10}\text{ solution}\right)$, and acidulated $KClO_3$: estimate excess of $AgNO_3$. $KClO_3 + 3HCHO + AgNO_3 = 3HCOOH + KNO_3 + AgCl$	9·0048	0·9544741
Formic acid, . . .	HCOOH	$3HCOOH \equiv 2KMnO_4 \equiv 5O$	1·38048	0·1400301
		$5HCOOH + 2HIO_3 = 5CO_2 + 6H_2O + 2I$	11·504	1·0608489
Glycerol, . . .	$C_3H_5(OH)_3$	With $KMnO_4$ in strongly alkaline solution at ordinary temperature : $C_3H_8O_3 \equiv 6O$	0·7672	$\bar{1}$·8849086
		$C_3H_8O_3 + 5HI = 3H_2O + C_3H_7I + 4I$	2·3016	0·3620298
		In presence of concentrated H_2SO_4 and HIO_3 the following equation holds : $5C_3H_8O_3 + 7I_2O_5 = 15CO_2 + 20H_2O + 14I$	3·288	0·5169318
Hydrazine, . . .	N_2H_4	In hydrate or compounds add alkaline carbonate and titrate directly against $\frac{N}{10}$I : $N_2H_4 \equiv 4I$	0·8023	$\bar{1}$·9046074
Hydrazine sulphate. .	$N_2H_4.H_2SO_4$	Like preceding : $N_2H_6SO_4 \equiv 4I$	3·2547	0·5125110
		Treat with $NaIO_3$ and then estimate NaI formed $6N_2H_6SO_4 + 4NaIO_3 = 2Na_2SO_4 + 4H_2SO_4 + 4HI + 12H_2O + 6N_2$	19·5282	1·2906622
Hydroxylamine, . .	NH_2OH	$2NH_3O + 2I_2 = N_2O + H_2O + 4HI$	0·8266	$\bar{1}$·9172954

Indigo,	$C_{16}H_{10}N_2O_2$	Against $KMnO_4$: $C_{16}H_{10}N_2O_2 \equiv 2O$	6·554	0·8165064
Iodoform,	CHI_3	Decompose and digest with excess of $\frac{N}{10}$ $AgNO_3$: $CHI_3 \equiv 3AgNO_3$	13·1306	1·1182846
Lactic acid,	$CH_3CH(OH)COOH$	Against $KMnO_4$ at ordinary temperatures: $C_3H_6O_3 + 5O = CO_2 + C_2H_2O_4 + 2H_2O$	0·9004$\dot{8}$	$\bar{1}$·9544741
Mercaptan-(ethyl),	$C_2H_5.SH$	$C_2H_6S + HgCl_2 = C_2H_5.SHgCl + HCl$, estimate $HgCl_2$ in filtrate	3·1054	0·4921175
,, (methyl).	CH_3HS	Precipitate with excess of $\frac{N}{10}HgCl_2$, filter, estimate excess in filtrate	2·4046	0·3810428
,, (propyl).	C_3H_7HS		4·5024	0·6534441
Methylaniline,	$C_6H_5NHCH_3$	Diazotising : $C_7H_9N \equiv NaNO_2 \equiv O$	5·3556	0·7288081
		Bromination : $C_7H_9N \equiv 6Br$	1·7852	0·2516869
Morphine,	$C_{17}H_{19}NO_3$	Against acid solution of I and KI. 1 mol. morphine ≡ 3I	9·5064	0·9780161
,, cryst,	$C_{17}H_{19}NO_3 + H_2O$		16·1069$\dot{3}$	1·0046193
Mustard oil,	$CH_2:CHCH_2NCS$	$CH_2 : CHCH_2NCS + Br_2 = CH_2BrCHBrCH_2NCS$	4·957	0·6952189
Naphthol (Beta),	$C_{10}H_7OH$	$C_{10}H_8O \equiv 3I$	4·8021$\dot{3}$	0·6814341
Naphthylamine,	$C_{10}H_7NH_2$	Diazotising : $C_{10}H_9N \equiv NaNO_2 \equiv O$	7·1556	0·8546461
Nitraniline (o and p),	$C_6H_4(NO_2)NH_2$	$C_6H_6N_2O_2 \equiv 4I$	3·4532	0·5359520
,, (m),	$C_6H_4(NO_2)NH_2$	$C_6H_6N_2O_2 \equiv 6I$	2·3021$\dot{3}$	0·3621304
Phenacetin,	$C_6H_4(OC_2H_5)(NH.C_2H_3O)$	Bromination : $C_{10}H_{13}NO_2 \equiv 2Br$	8·9572	0·9521723
Phenol,	C_6H_5OH	Bromination : $C_6H_5OH \equiv 6Br$ $C_6H_5OH \equiv 6I$	1·5674$\dot{6}$	0·1951983
Phenylene-diamine (m).	$C_6H_4(NH_2)_2$	Diazotising : $C_6H_8N_2 \equiv 2NaNO_2 \equiv 2O$	2·7036	0·4319424
Phenylhydrazine,	$C_6H_5NH.NH_2$	Bromination : $C_6H_8N_2 \equiv 4Br$	2·7036	0·4319424
		$2C_6H_8N_2 \equiv 4I$	5·4072	0·7329724
Quinone,	$C_6H_4O_2$	$C_6H_4O_2 + 2KI + 2KCl = C_6H_6O_2 + 2KCl + I_2$	5·4016	0·7325224
Resorcin,	$C_6H_4(OH)_2$	Bromination : $C_6H_6O_2 \equiv 6Br$	1·8341$\dot{3}$	0·2634309
Salicylic acid,	$C_6H_4(OH)COOH$	$C_7H_6O_3 + 6I + 4NaOH = NaC_7H_2I_3O_3 + 3NaI + 4H_2O$	2·3008	0·3618789
Strychnine,	$C_{21}H_{22}N_2O_2$	Against acid solution of I and KI. 1 mol. strychnine ≡ 6I	5·5709$\dot{3}$	0·7459279
Tannin,	$C_{14}H_{10}O_9$	Against $KMnO_4$; $C_{14}H_{10}O_9 \equiv 24O$	0·646	$\bar{1}$·8102325
Tolidine,	$(NH_2)(CH_3)C_6H_3.C_6H_3(CH_3)(NH_2)$	$C_{14}H_{16}N_2 \equiv 2I$	10·6104	1·0257318
Toluidine (o and p).	$C_6H_4(CH_3)NH_2$	$C_7H_9N \equiv 4Br$	2·6778	0·4277781
,, (p).		$C_7H_9N \equiv 6Br$	1·7852	0·2516869
Thymol,	$C_6H_3(CH_2CH_2CH_3)(OH)(CH_3)$	$C_{10}H_{14}O \equiv 4I$	3·7528	0·5743554
Urea,	$CO(NH_2)_2$	Against acid nitrate solution : $CH_4N_2O \equiv 2HNO_2 \equiv 2O$	3·0056	0·4779312
Uric acid,	$C_5H_4N_4O_3$	$C_5H_4N_4O_3 + I_2 + H_2O = CO(NH_2)_2 + C_4H_2N_2O_4 + 2HI$	8·4096	0·9247753
		Against $KMnO_4$: $C_5H_4N_4O_3 \equiv 3O$	2·8032	0·4476541
Xylidines,	$C_6H_3.CH_3.CH_3.NH_2$	Each molecule of the compounds 1.2.4, 1.2.3, and 1.4.2 ≡ 4Br	3·0282	0·4811846
		Each molecule of 1.3.4 and 1.3.2 ≡ 2Br	6·0564	0·7822146

TABLE LXXVc.—Weights of Substances to be taken so that each Centigramme of Precipitate ≡ 1% of Substance to be estimated.

By means of this table all calculations in connection with gravimetric estimations are dispensed with, *e.g.*—

(1) In an analysis of artificial manure the phosphates present are to be precipitated with magnesia mixture and weighed as $Mg_2P_2O_7$; if we want to know the percentage of P in the original manure, the table shows that we must take 0·2786 grm. of the original sample for analysis, and then each 0·01 grm. $Mg_2P_2O_7$ corresponds to 1 per cent. of P.

(2) To find the percentage of Ag in a silver coin by dissolving the coin in nitric acid, precipitating the silver as AgCl, washing, drying, and weighing.

The table shows that we should take 0·7527 grm. of the coin, then each centigramme of AgCl obtained ≡ 1 per cent. of Ag in the coin: thus, if the weight of AgCl obtained amounts to 0·9249 grm., the percentage of Ag in the coin would be 92·49.

The judicious use of this table will save busy analysts and assayers a vast deal of time and trouble, as the balance gives the percentages required.

Formula of Precipitate as weighed.	Formula of Substance the Percentage of which is required.	Weight of Sample to be taken.	Formula of Precipitate as weighed.	Formula of Substance the Percentage of which is required.	Weight of Sample to be taken.
Aluminium—			Arsenic—		
Al_2O_3,	Al	0·5303	As_4S_6,	As_2O_5	0·9843
	Al_2Br_6	5·2246		As_2S_5	1·2605
	Al_2Cl_6	2·6115	As_4O_6,	As	0·7576
	$Al_2(SO_4)_3$	3·3501		As_2O_5	1·1616
	$Al_2(SO_4)_3+18H_2O$	6·5232		As_4S_6	1·2433
	$K_2Al_2(SO_4)_4+24H_2O$	9·2869		As_2S_5	1·5671
$Al_2P_2O_8$,	Al	0·2219	As_2O_5,	As	0·6522
	Al_2Br_6	2·1866		As_4O_6	0·8609
	Al_2Cl_6	1·0930		As_4S_6	1·0703
	Al_2O_3	0·4185		As_2S_5	1·3491
	$Al_2(SO_4)_3$	1·4020	$(MgNH_4AsO_4)_2+H_2O$	As	0·3938
	$Al_2(SO_4)_3+18H_2O$	2·7300		As_4O_6	0·5198
	$K_2Al_2(SO_4)_4+24H_2O$	3·8867		As_2O_5	0·6039
Antimony—			$MgNH_4AsO_4+6H_2O$	As	0·2690
Sb_2O_4,	Sb_2	0·7898		As_4O_6	0·3419
	Sb_2O_3	0·9474		As_2O_5	0·3972
	Sb_2O_5	1·0526	$Mg_2As_2O_7$,	As	0·4827
	Sb_2S_3	1·1057		As_4O_6	0·6372
	Sb_2S_5	1·3164		As_4S_6	0·7923
	$K_2Sb_2O_2(C_4H_4O_6)_2$	2·1839		As_2O_5	0·7402
	$+H_2O$		$(UO_2)_2As_2O_7$,	As	0·1868
Sb_2O_3,	Sb_2	0·8336		As_4O_6	0·2466
	Sb_2S_3	1·1671		As_4S_6	0·3066
Sb_2O_5,	Sb_2	0·7505		As_2O_5	0·2864
	Sb_2S_3	1·0505	$BiAsO_4$,	As	0·2158
Sb_2S_3,	Sb_2	0·7142		As_4O_6	0·2849
	Sb_2O_3	0·8569		As_4S_6	0·3542
Sb_2S_5,	Sb_2	0·5999		As_2O_5	0·3309
	Sb_2S_3	0·8400	$Pb_3As_2O_8$,	As	0·1669
$Na_2H_2Sb_2O_7$,	Sb_2	0·6002		As_4O_6	0·2205
	Sb_2S_3	0·8404		As_4S_6	0·2739
$C_6H_2(OH)_3COOSbO$	Sb_2	0·3938		As_2O_5	0·2559
	Sb_2S_3	0·5513	Barium—		
Arsenic—			$BaSO_4$,	Ba	0·5885
As_4S_6,	As	0·6093		BaO	0·6570
	As_4O_6	0·8043		$Ba(OH)_2$	0·7342

TABLE LXXVc.—*continued.*

Formula of Precipitate as weighed.	Formula of Substance the Percentage of which is required.	Weight of Sample to be taken.
Barium—		
$BaSO_4$, . .	$BaCO_3$	0·8455
	$BaCl_2$	0·8922
	$BaCl_2 + 2H_2O$	1·0466
	$Ba(NO_3)_2$	1·1200
$BaCO_3$, . .	Ba	0·6960
	BaO	0·7771
	$Ba(OH)_2$	0·8684
	$BaCl_2$	1·0552
	$BaCl_2 + 2H_2O$	1·2378
	$Ba(NO_3)_2$	1·3246
	$BaSO_4$	1·1827
$BaCrO_4$, . .	Ba	0·5420
	BaO	0·6051
	$Ba(OH)_2$	0·6762
	$BaCO_3$	0·7787
	$BaCl_2$	0·8217
	$BaCl_2 + 2H_2O$	0·9638
	$Ba(NO_3)_2$	1·0312
	$BaSO_4$	0·9209
Beryllium—		
BeO . .	Be	0·3625
	$BeCl_2$	3·1873
	$BeSO_4$	4·1896
	$BeSO_4 + 4H_2O$	7·0607
Bismuth—		
Bi, . . .	Bi_2O_3	1·1151
	Bi_2S_3	1·2306
Bi_2O_3, . .	Bi	0·8968
	Bi_2S_3	1·1036
Bi_2S_3, . .	Bi	0·8126
	Bi_2O_3	0·9061
$BiAsO_4$, . .	Bi	0·6000
	Bi_2O_3	0·6691
	Bi_2S_3	0·7384
BiOCl, . .	Bi	0·8021
	Bi_2O_3	0·8944
	Bi_2S_3	0·9871
Boron—		
B_2O_3, . .	B	0·3142
KBF_4, . .	B	0·0872
	B_2O_3	0·2774
Bromine—		
AgBr, . .	Br_2	0·4256
	HBr	0·4309
	NaBr	0·5482
	KBr	0·6339
	Br_2O_3	0·6385
Cadmium—		
CdO, . .	Cd	0·8754
	CdS	1·1251
	$CdSO_4$	1·6235
	$Cd(NO_3)_2$	1·8417
CdS, . .	Cd	0·7781
	CdO	0·8888

Formula of Precipitate as weighed.	Formula of Substance the Percentage of which is required.	Weight of Sample to be taken.
Cadmium—		
$CdSO_4$, . .	Cd	0·5392
	CdO	0·6159
Caesium—		
CsCl, . .	Cs	0·7894
Cs_2SO_4, . .	Cs	0·7345
	CsCl	0·9305
AgCl, . .	Cs	0·9269
	CsCl	1·1742
Calcium—		
CaO, . .	Ca	0·7148
	$CaCO_3$	1·7843
	$CaSO_4$	2·4271
	$Ca_3P_2O_8$	1·8437
$CaCO_3$, . .	Ca	0·4006
	CaO	0·5604
	$CaSO_4$	1·3602
	$Ca_3P_2O_8$	1·0333
$Ca_3P_2O_8$, . .	Ca	0·3877
	CaO	0·5424
	$CaCO_3$	0·9678
	$CaSO_4$	1·3164
Carbon—		
CO_2, . .	C	0·2727
$CaCO_3$, . .	C	0·1200
	CO_2	0·4396
$BaCO_3$, . .	C	0·0608
	CO_2	0·2229
Cerium—		
CeO_2, . .	Ce	0·8142
	Ce_2O_3	0·9534
	$Ce_2(SO_4)_3$	1·6493
	$Ce_2(SO_4)_3 + 5H_2O$	1·9122
	$Ce_2(C_2O_4)_3 + 9H_2O$	2·0512
Chlorine—		
AgCl, . .	Cl	0·2472
	HCl	0·2543
	Cl_2O	0·3030
	HClO	0·3659
	Cl_2O_3	0·4146
	$HClO_2$	0·4775
	Cl_2O_5	0·5262
	$HClO_3$	0·5891
	Cl_2O_7	0·6378
	$HClO_4$	0·7006
Chromium—		
Cr_2O_3, . .	Cr	0·6846
	CrO_3	1·3154
	Cr_2Cl_6	2·0821
	$Cr_2(SO_4)_3$	2·5781
	K_2CrO_4	2·5545
	$K_2Cr_2O_7$	1·9350
	$K_2Cr_2(SO_4)_4 + 24H_2O$	6·5645
Cr_2O_3, . .	CrO_2Cl_2	2·0368
	$K_2Cr_2O_6Cl_2$	2·2957

TABLE LXXVc.—*continued.*

Formula of Precipitate as weighed.	Formula of Substance the Percentage of which is required.	Weight of Sample to be taken.
Chromium—		
$BaCrO_4$, . .	Cr	0·2055
	Cr_2O_3	0·3002
	CrO_3	0·3949
	Cr_2Cl_6	0·6250
	$K_2Cr_2O_7$	0·5809
$PbCrO_4$, . .	Cr	0·1613
	Cr_2O_3	0·2356
	CrO_3	0·3099
	Cr_2Cl_6	0·4906
	$K_2Cr_2O_7$	0·4559
$K_2Cr_2O_7$, . .	Cr	0·3538
	Cr_2O_3	0·5168
	CrO_3	0·6798
CO_2, . .	Cr	0·3947
	CrO_3	0·7583
	K_2CrO_4	1·4727
	$K_2Cr_2O_7$	1·1155
Cobalt—		
Co, . . .	CoO	1·2712
	Co_3O_4	1·3616
	Co_2O_3	1·4068
	$CoCl_2$	2·2017
	$CoCl_2+6H_2O$	4·0325
	$CoSO_4$	2·6281
	$CoSO_4+7H_2O$	4·7656
	$Co(NO_3)_2+6H_2O$	4·9352
CoO, . .	Co	0·7867
	$CoCl_2$	1·7320
	$CoSO_4$	2·0675
Co_3O_4, . .	Co	0·7344
	CoO	0·9336
	$CoCl_2$	1·6170
	$CoSO_4$	1·9302
$CoSO_4$, . .	Co	0·3805
	CoO	0·4837
$K_3Co(NO_2)_6$, .	Co	0·1303
	CoO	0·1657
Copper—		
Cu, . .	Cu_2O	1·1258
	CuO	1·2516
	Cu_2S	1·2520
	CuS	1·5041
	Cu_2Cl_2	1·5574
	$CuCl_2$	2·1148
	$CuCl_2+2H_2O$	2·6813
	$CuSO_4$	2·5104
	$CuSO_4+5H_2O$	3·9267
Cu_2O, . .	Cu	0·8883
	CuO	1·1117
	Cu_2S	1·1122
	CuS	1·3360
CuO, . .	Cu	0·7990
	Cu_2O	0·8995
	Cu_2S .	1·0004
Copper—		
CuO, . .	CuS	1·2018
Cu_2S, . .	Cu	0·7987
	CuO	0·9996
CuS, . .	Cu	0·6649
	CuO	0·8321
$Cu_2(CNS)_2$, .	Cu	0·5226
	CuO	0·6541
Erbium—		
Er_2O_3, . .	Er	0·8737
	$Er_2(SO_4)_3$	1·6321
	$Er_2(SO_4)+_37H_2O$	1·9639
Fluorine—		
CaF_2, . .	F	0·4866
	HF	0·5124
	H_2SiF_6	0·6164
K_2SiF_6, . .	F	0·5165
	HF	0·5439
	CaF_2	1·0616
	SiF_4	0·7096
$BaSiF_6$, . .	F	0·4074
	HF	0·4290
	CaF_2	0·8374
	SiF_4	0·5597
SiO_2, . .	F	3·7748
	HF	3·9751
	CaF_2	7·7583
	SiF_4	5·1854
Gallium—		
Ga_2O_3, . .	Ga	0·7447
	$GaCl_2$	1·4989
	Ga_2Cl_6	1·8761
	$Ga_2(NO_3)_6$	2·7247
	$Ga_2(SO_4)_3$	2·2776
	$(NH_4)_2Ga_2(SO_4)_4+24H_2O$	5·2807
Germanium—		
GeO_2, . .	Ge	0·6938
	$GeCl_4$	2·0507
	$Gebr_4$	3·7544
	GeI_4	5·5493
	GeS_2	1·3074
Gold—		
Au, . . .	$AuCl_3$	1·5393
	Au_2O_3	1·1217
	Au_2S	1·0813
	Au_2S_2	1·2439
Hydrogen—		
H_2O, . .	H	0·1119
Indium—		
In_2O_3, . .	In	0·8261
	$InCl_3$	1·5967
	$In_2(SO_4)_3$	1·8702
	$(NH_4)_2In_2(SO_4)_4+24H_2O$	3·9158

TABLE LXXVc.—*continued*.

Formula of Precipitate as weighed.	Formula of Substance the Percentage of which is required.	Weight of Sample to be taken.
Iodine—		
AgI,	I	0·5405
	HI	0·5448
	I_2O_5	0·7108
	I_2O_7	0·7789
PbI_2,	I	0·5510
	HI	0·5554
	I_2O_5	0·7246
	I_2O_7	0·7940
PdI_2,	I	0·7045
	HI	0·7101
	I_2O_5	0·9265
	I_2O_7	1·0153
TlI,	I	0·3835
	HI	0·3868
	I_2O_5	0·5043
	I_2O_7	0·5527
Iridium—		
Ir,	$IrCl_4$	1·7347
$(NH_4)_2IrCl_6$,	Ir	0·4368
	$IrCl_4$	0·7577
K_2IrCl_6,	Ir	0·3988
	$IrCl_4$	0·6917
Iron—		
Fe_2O_3,	Fe	0·6996
	F_2O_2	0·8999
	Fe_3O_4	0·9666
	FeS	1·1009
Fe_3O_4,	Fe	0·7239
	Fe_2O_2	0·9309
	Fe_2O_3	1·0345
	FeS	1·1389
FeS,	Fe	0·6355
	Fe_2O_2	0·8174
	Fe_3O_4	0·8781
	Fe_2O_3	0·9084
$Fe_3P_2O_8$,	Fe	0·4688
	F_2O_2	0·6030
	Fe_3O_4	0·6477
	Fe_2O_3	0·6701
	FeS	0·7377
Lanthanum—		
La_2O_3,	La	0·8527
	La_2Cl_6	1·5055
	$La_2(SO_4)_3$	1·7372
	$La_2(SO_4)_3 + 9H_2O$	2·2349
Lead—		
Pb,	PbO	1·0773
	PbS	1·1549
	$PbCl_2$	1·3427
	PbI_2	2·2273
	$PbSO_4$	1·4643
PbO,	Pb	0·9282
	PbS	1·0721

Formula of Precipitate as weighed.	Formula of Substance the Percentage of which is required.	Weight of Sample to be taken.
Lead—		
PbO,	$PbSO_4$	1·3592
$PbCl_2$,	Pb	0·7448
	PbO	0·8024
	PbS	0·8602
PbI_2,	Pb	0·4492
	PbO	0·4839
	PbS	0·5188
PbS,	Pb	0·8658
	PbO	0·9328
$PbSO_4$,	Pb	0·6829
	PbO	0·7357
	PbS	0·7888
$PbCrO_4$,	Pb	0·6406
	PbO	0·6901
	PbS	0·7398
$Pb_3P_2O_8$,	Pb	0·7656
	PbO	0·8248
	PbS	0·8843
Lithium—		
$LiCl$,	Li	0·1654
Li_2SO_4,	Li	0·1277
	$LiCl$	0·7715
Li_2CO_3,	Li	0·1898
	$LiCl$	1·1472
Li_3PO_4,	Li	0·1817
	$LiCl$	1·0978
$AgCl$,	Li	0·0490
	$LiCl$	0·2968
Magnesium—		
MgO,	Mg	0·6036
	$MgCO_3$	2·0902
	$MgSO_4$	2·9836
	$MgSO_4 + 7H_2O$	6·1083
$MgSO_4$,	Mg	0·2023
	MgO	0·3352
	$MgCO_3$	0·7005
	$MgSO_4 + 7H_2O$	2·0473
$Mg_2P_2O_7$,	Mg	0·2188
	MgO	0·3624
	$MgCO_3$	0·7575
	$MgSO_4 + 7H_2O$	2·2138
Manganese—		
Mn_3O_4,	Mn	0·7202
	MnO	0·9301
	MnO_2	1·1397
	$MnSO_4$	1·9790
Mn_2O_3,	Mn	0·6962
	MnO	0·8987
	MnO_2	1·1013
	$MnSO_4$	1·9122
MnS,	Mn	0·6317
	MnO	0·8155
	MnO_2	0·9993
	$MnSO_4$	1·7351

TABLE LXXVc.—*continued.*

Formula of Precipitate as weighed.	Formula of Substance the Percentage of which is required.	Weight of Sample to be taken.
Manganese—		
$MnSO_4$,	Mn	0·3641
	MnO	0·4700
	MnO_2	0·5759
	MnS	0·5763
$Mn_2P_2O_7$,	Mn	0·3873
	MnO	0·5000
	MnO_2	0·6127
	$MnSO_4$	1·0638
Mercury—		
Hg,	Hg_2Cl_2	1·1773
	$HgCl_2$	1·3545
	$HgBr_2$	1·7996
	HgI_2	2·2685
	$Hg(CN)_2$	1·2604
	HgO	1·0800
	HgS	1·1603
HgO,	Hg	0·9259
	Hg_2Cl_2	1·0900
	$HgCl_2$	1·2542
	HgS	1·0744
HgS,	Hg	0·8618
	Hg_2Cl_2	1·0146
	$HgCl_2$	1·1674
	HgO	0·9308
Hg_2Cl_2,	Hg	0·8494
	$HgCl_2$	1·1506
	HgO	0·9174
	HgS	0·9856
Molybdenum—		
Mo,	MoO_3	1·5000
	MoS_3	2·0018
MoO_3,	Mo	0·6667
	MoS_3	1·3346
MoS_3,	Mo	0·4995
	MoO_3	0·7493
$PbMoO_4$,	Mo	0·2617
	MoO_3	0·3925
	MoS_3	0·5238
Nickel—		
Ni,	NiO	1·2726
	NiS	1·5462
	$NiSO_4$	2·6365
	$NiSO_4 + 7H_2O$	4·7848
	$NiCl_2 + 6H_2O$	4·0493
	$Ni(NO_3)_2 + 6H_2O$	4·9553
	$Ni_3(PO_4)_2 + 7H_2O$	2·8235
NiO,	Ni	0·7858
	NiS	1·2150
	$NiSO_4$	2·0718
NiS,	Ni	0·6468
	NiO	0·8230
	$NiSO_4$	1·7051
$NiSO_4$,	Ni	0·3793
	NiO	0·4827
Nickel—		
$NiSO_4$,	NiS	0·5865
	$NiSO_4 + 7H_2O$	1·8149
Niobium—		
Nb_2O_5,	Nb	0·3507
	NbO	0·4104
	NbO_2	0·4701
	$NbCl_5$	1·0121
Nitrogen—		
NH_3,	N	0·8228
	NH_4Cl	3·1365
	$(NH_4)_2SO_4$	3·8738
	HNO_2	2·7571
	HNO_3	3·6948
	$NaNO_3$	4·9865
	KNO_3	5·9300
	HCN	1·5851
	KCN	3·8203
	$CO(NH_2)_2$	1·7614
	$C_5H_4N_4O_3$	2·4641
NH_4Cl,	N	0·2623
	NH_3	0·3188
	$(NH_4)_2SO_4$	1·2350
	HNO_3	1·1780
	$NaNO_3$	1·5898
	KNO_3	1·8906
	$CO(NH_2)_2$	0·5616
	$C_5H_4N_4O_3$	0·7856
$(NH_4)_2SO_4$,	N	0·2124
	NH_3	0·2581
	NH_4Cl	0·8097
	HNO_3	0·9538
	$NaNO_3$	1·2873
	KNO_3	1·5308
	$CO(NH_2)_2$	0·4547
	$C_5H_4N_4O_3$	0·6361
AgCN,	CN	0·1944
	HCN	0·2019
	KCN	0·4866
Ag,	CN	0·2413
	HCN	0·2506
	KCN	0·6040
AgCl,	N	0·0979
	NH_3	0·1190
	NH_4Cl	0·3733
	HNO_3	0·4397
	$CO(NH_2)_2$	0·2096
	$C_5H_4N_4O_3$	0·2933
$(NH_4)_2PtCl_6$,	N	0·0633
	NH_3	0·0769
	NH_4Cl	0·2413
	$(NH_4)_2SO_4$	0·2980
	HNO_3	0·2842
	$CO(NH_2)_2$	0·1355
	$C_5H_4N_4O_3$	0·1896

TABLE LXXVc.—*continued.*

Formula of Precipitate as weighed.	Formula of Substance the Percentage of which is required.	Weight of Sample to be taken.
Nitrogen—		
Pt,	N	0·1441
	NH_3	0·1752
	NH_4Cl	0·5495
	$(NH_4)_2SO_4$	0·6787
	HNO_3	0·6473
	$CO(NH_2)_2$	0·3086
	$C_5H_4N_4O_3$	0·4317
Osmium—		
Os,	$OsCl_4$	1·7424
	OsO_4	1·3351
Oxygen—		
H_2O,	O	0·8881
Palladium—		
Pd,	$PdCl_2$	1·6657
	PdI_2	3·3844
	$(NH_4)_2PdCl_4$	2·6708
	$(NH_4)_2PdCl_6$	3·3366
	K_2PdCl_4	3·0667
	K_2PdCl_6	3·7324
PdI_2,	Pd	0·2957
$(NH_4)_2PdCl_4$,	Pd	0·3744
K_2PdCl_4,	Pd	0·3261
	$PdCl_2$	0·5432
	K_2PdCl_6	1·2171
Phosphorus—		
$Mg_2P_2O_7$,	P	0·2784
	P_2O_5	0·6376
	$Ca_3P_2O_8$	1·3932
	$Ca_2H_2P_2O_8$	1·2222
	$CaH_4P_2O_8$	1·0512
$(UO_2)_2P_2O_7$,	P	0·0867
	P_2O_5	0·1986
	$Ca_3P_2O_8$	0·4340
	$Ca_2H_2P_2O_8$	0·3807
	$CaH_4P_2O_8$	0·3275
$Fe_2P_2O_8$,	P	0·2054
	P_2O_5	0·4705
$Pb_3P_2O_8$,	P	0·0765
	P_2O_5	0·1752
$Mg_3P_2O_8$,	P	0·2357
	P_2O_5	0·5398
Ag_3PO_4,	P	0·0740
	P_2O_5	0·1695
$Ag_4P_2O_7$,	P	0·1024
	P_2O_5	0·2344
Platinum—		
Pt,	$PtCl_4$	1·7279
	$(NH_4)_2PtCl_6$	2·2774
	K_2PtCl_6	2·4938
	Tl_2PtCl_6	4·1874
$(NH_4)_2PtCl_6$,	Pt	0·4391
	$PtCl_4$	0·7587
K_2PtCl_6,	Pt	0·4010
	$PtCl_4$	0·6929
Platinum—		
Tl_2PtCl_6,	Pt	0·2388
	$PtCl_4$	0·4127
Potassium—		
KCl,	K	0·5248
	K_2O	0·6320
	KOH	0·7528
	KBr	1·5966
	KI	2·2265
	KNO_3	1·3544
	K_2SO_4	1·1686
	$KClO_3$	1·6434
	$KClO_4$	1·8579
K_2SO_4,	K	0·4491
	K_2O	0·5408
	KOH	0·6442
	KCl	0·8557
	KNO_3	1·1590
$KClO_4$,	K	0·2825
	KCl	0·5382
K_2PtCl_6,	K	0·1612
	K_2O	0·1941
	KOH	0·2312
	KCl	0·3071
	KNO_3	0·4160
K_2SiF_6,	K	0·3549
	K_2O	0·4273
$K_2Cr_2O_7$,	K	0·2659
	K_2O	0·3202
AgCl,	K	0·2744
	K_2O	0·3288
	KOH	0·3917
	KCl	0·5203
	$KClO_3$	0·8551
	$KClO_4$	0·9667
$BaSO_4$,	K	0·3354
	K_2O	0·4039
	KOH	0·4811
	KCl	0·6391
	KNO_3	0·8656
	K_2SO_4	0·7469
Rhodium—		
Rh,	$RhCl_3$	2·0825
	$(NH_4)_3RhCl_6$	3·5914
Rubidium—		
RbCl,	Rb	0·7072
Rb_2SO_4,	Rb	0·6400
	RbCl	0·9050
AgCl,	Rb	0·5956
	RbCl	0·8422
Ruthenium—		
Ru,	$RuCl_2$	1·6971
	$RuCl_3$	2·0457
	RuO	1·1573
	Ru_2O_3	1·2360

TABLE LXXVc.—*continued.*

Formula of Precipitate as weighed.	Formula of Substance the Percentage of which is required.	Weight of Sample to be taken.
Ruthenium—		
Ru, . .	RuO_2	1·3147
	$KRuO_4$	2·0143
Scandium—		
Sc_2O_3, . .	Sc	0·6476
	$Sc_2(SO_4)_3$	2·7634
	$Sc_2(SO_4)_3+6H_2O$	3·5571
Selenion—		
Se, . . .	SeO_2	1·4040
	SeS_2	1·8096
	$SeCl_2$	1·8952
SeS_2, . .	Se	0·5526
	SeO_2	0·7759
	$SeCl_2$	1·0473
Silicon—		
SiO_2, . .	Si	0·4702
	SiF_4	1·7284
	$SiCl_4$	2·8179
	H_2SiF_6	2·3910
	K_2SiF_6	3·6540
	$BaSiF_6$	4·6325
K_2SiF_6, . .	Si	0·1287
	SiO_2	0·2737
	SiF_4	0·4730
	$SiCl_4$	0·7712
$BaSiF_6$, . .	Si	0·1015
	SiO_2	0·2159
	SiF_4	0·3731
	$SiCl_4$	0·6083
Silver—		
Ag, . . .	Ag_2O	1·0741
	Ag_2S	1·1485
	AgCl	1·3285
	AgBr	1·7409
	AgI	2·1764
	AgCN	1·2413
	$AgNO_3$	1·5748
AgCl, . .	Ag	0·7528
	Ag_2O	0·8086
	Ag_2S	0·8646
	$AgNO_3$	1·1855
AgBr, . .	Ag	0·5744
	Ag_2O	0·6170
	$AgNO_3$	0·9047
AgI, . .	Ag	0·4595
	Ag_2O	0·4935
	$AgNO_3$	0·7236
Ag_2S, . .	Ag	0·8707
	Ag_2O	0·9352
	$AgNO_3$	1·3712
AgCN, . .	Ag	0·8056
	Ag_2O	0·8653
	$AgNO_3$	1·2687
Ag_3PO_4 . .	Ag	0·7732
	Ag_2O	0·8305

Formula of Precipitate as weighed.	Formula of Substance the Percentage of which is required.	Weight of Sample to be taken.
Silver—		
Ag_3PO_4, . .	$AgNO_3$	1·2176
$Ag_4P_2O_7$, . .	Ag	0·7127
	Ag_2O	0·7656
	$AgNO_3$	1·1224
Sodium—		
NaCl, . .	Na	0·3940
	Na_2O	0·5307
	NaOH	0·6848
	Na_2CO_3	0·9068
	$NaNO_3$	1·4545
Na_2SO_4, . .	Na	0·3243
	Na_2O	0·4368
	NaOH	0·5636
	Na_2CO_3	0·7463
	$NaNO_3$	1·1971
	NaCl	0·8230
Na_2CO_3, . .	Na	0·4345
	Na_2O	0·5853
	NaOH	0·7551
$Na_2H_2Sb_2O_7$, .	Na	0·1151
	Na_2O	0·1550
	NaOH	0·2000
	Na_2CO_3	0·2649
	NaCl	0·2921
AgCl, . .	Na	0·1608
	NaCl	0·4080
Strontium—		
SrO, . .	Sr	0·8456
	$Sr(OH)_2$	1·1739
	$SrCO_3$	1·4247
	$SrCl_2$	1·5299
	$Sr(NO_3)_2$	2·0432
$SrSO_4$, . .	Sr	0·4770
	SrO	0·5641
	$SrCl_2$	0·8630
$SrCO_3$, . .	Sr	0·5935
	SrO	0·7019
$SrCl_2$, . .	Sr	0·5527
	SrO	0·6536
$Sr(NO_3)_2$ . .	Sr	0·4138
	SrO	0·4894
Sulphur—		
$BaSO_4$, . .	S	0·1373
	H_2S	0·1460
	SO_2	0·2744
	SO_3	0·3429
	SO_4	0·4115
	H_2SO_4	0·4201
	S_2Cl_2	0·2892
As_4S_6, . .	S	0·3907
	H_2S	0·4152
CdS, . .	S	0·2219
	H_2S	0·2359

TABLE LXXVc.—*continued.*

Formula of Precipitate as weighed.	Formula of Substance the Percentage of which is required.	Weight of Sample to be taken.
Tantalum—		
Ta_2O_5,	Ta	0·8206
	$TaCl_5$	1·6155
Tellurium—		
Te,	TeO_2	1·2508
	$TeCl_2$	1·5569
	$TeCl_4$	2·1066
	H_2TeO_4	1·5174
TeO_2,	Te	0·7995
	H_2TeO_4	1·2131
Thallium—		
Tl_2S,	Tl	0·9272
	Tl_2O	0·9635
	TlCl	1·0882
Tl_2PtCl_6,	Tl	0·5004
	Tl_2O	0·5200
	TlCl	0·5873
Thorium—		
ThO_2,	Th	0·8790
	$Th(SO_4)_2$	1·6054
	$Th(SO_4)_2+9H_2O$	2·2184
Tin—		
SnO_2,	Sn	0·7881
	Sn_2Cl_4	1·1914
	$Sn_2Cl_4+4H_2O$	1·4308
	$SnCl_4$	1·6609
	$SnCl_4+5H_2O$	2·2574
	SnS_2	1·2127
Titanium—		
TiO_2,	Ti	0·6005
	$TiCl_4$	2·3708
	TiF_4	1·5493
	K_2TiF_6	3·0012
Tungsten—		
WO_3,	W	0·7931
	WCl_6	1·7099
	$Na_2WO_4+2H_2O$	1·4230
	$CaWO_4$	1·2418
Uranium—		
U_3O_8,	U	0·8483
	UO_2	0·9621
	UO_3	1·0190
	UCl_4	1·3512
	$UO_2(NO_3)_2+6H_2O$	1·7878
	$UO_2SO_4+3H_2O$	1·4959
	$(UO_2)_2P_2O_7$	1·2715
Uranium—		
U_3O_8	$K_2U_2O_7$	1·1867
$(UO_2)_2P_2O_7$,	U	0·6671
	UO_2	0·7566
	U_3O_8	0·7898
$K_2U_2O_7$,	U	0·7148
	UO_2	0·8107
	UO_3	0·8587
Vanadium—		
V_2O_5,	V	0·5614
V_2O_5,	VCl_4	2·1162
	$NaVO_3$	1·3405
	$Pb(VO_3)_2$	2·2220
Ytterbium—		
Yb_2O_3,	Yb	0·8782
	$Yb_2(SO_4)_3$	1·6096
	$Yb_2(SO_4)_3+8H_2O$	1·9754
Yttrium—		
Y_2O_3,	Y	0·7876
	$Y_2(SO_4)_3$	2·0627
	$Y_2(SO_4)_3+8H_2O$	2·7005
Zinc—		
ZnO,	Zn	0·8034
	$ZnCO_3$	1·5410
	ZnS	1·1973
	$ZnSO_4$	1·9835
	$ZnSO_4+7H_2O$	3·5328
	$ZnCl_2$	1·6744
ZnO,	$ZnCl_2+3ZnO+4H_2O$	1·3899
$ZnCO_3$,	Zn	0·5215
	ZnO	0·6491
	ZnS	0·7772
	$ZnSO_4$	1·2876
ZnS,	Zn	0·6710
	ZnO	0·8352
	$ZnSO_4$	1·6567
$ZnSO_4$,	Zn	0·4051
	ZnO	0·5041
	ZnS	0·6036
Zirconium		
ZrO_2,	Zr	0·7390
	ZrF_4	1·3589
	ZrCl	1·8956
	K_2ZrF_6	2·3075
	ZrSiO	1·4927

TABLE LXXVD (1).—**For Analysis of Sulphur Compounds,** etc.

Weight of $BaSO_4$ obtained from 1 cm.^{3} of Vitriol or 1 grm. of Substance.	One Litre of Liquid contained of H_2SO_4.	100 Parts Original Substance corresponded to				
		S.	H_2S.	SO_2.	SO_3.	H_2SO_4.
Grm.						
0·01	4·20098	0·1373	0·1460	0·2744	0·3429	0·4201
02	8·40195	2747	2919	5488	6859	8402
03	12·60293	4120	4379	8232	1·0288	1·2603
04	16·80391	5493	5838	1·0976	3717	6804
05	21·00488	6866	7298	3720	7146	2·1005
06	25·20586	8240	8758	6464	2·0576	5206
07	29·40684	9613	1·0217	9208	4005	9407
08	33·60781	1·0986	1677	2·1952	7434	3·3608
09	37·80879	2359	3136	4695	3·0864	7809
10	42·00977	3733	4596	7439	4293	4·2010
11	46·21074	5106	6056	3·0183	7722	6211
12	50·41172	6479	7515	2927	4·1151	5·0412
13	54·61270	7852	8975	5671	4581	4613
14	58·81367	9226	2·0435	8415	8010	8814
15	63·01465	2·0599	1894	4·1159	5·1439	6·3015
16	67·21563	1972	3354	3903	4868	7216
17	71·41660	3345	4813	6647	8298	7·1417
18	75·61758	4719	6273	9391	6·1727	5618
19	79·81856	6092	7733	5·2135	5156	9819
20	84·01953	7465	9192	4879	8586	8·4020
21	88·22051	8838	3·0652	7623	7·2015	8221
22	92·42149	3·0212	2111	6·0367	5444	9·2421
23	96·62246	1585	3571	3111	8873	6622
24	100·82344	2958	5031	5855	8·2303	10·0823
25	105·02442	4331	6490	8598	5732	5024
26	109·22539	5705	7950	7·1342	9161	9225
27	113·42637	7078	9409	4086	9·2591	11·3426
28	117·62734	8451	4·0869	6830	6020	7627
29	121·82832	9824	2329	9574	9449	12·1828
30	126·02930	4·1198	3788	8·2318	10·2878	6029
31	130·23027	2571	5248	5062	6308	13·0230
32	134·43125	3944	6707	7806	9737	4431
33	138·63223	5317	8167	9·0550	11·3166	8632
34	142·83320	6691	9627	2294	6596	14·2833
35	147·03418	8064	5·1086	6038	12·0025	7034
36	151·23516	9437	2546	8782	3454	15·1235
37	155·43613	5·0810	4005	10·1526	6883	5436
38	159·63711	2184	5465	4270	13·0313	9637
39	163·83809	3557	6925	7014	3742	16·3838

TABLE LXXVd (1).—*continued.*

Weight of $BaSO_4$ obtained from 1 cm.³ of Vitriol or 1 grm. of Substance.	One Litre of Liquid contained of H_2SO_4.	100 Parts Original Substance corresponded to				
		S.	H_2S.	SO_2.	SO_3.	H_2SO_4.
Grms.						
0·40	168·03906	5·4930	5·8384	10·9758	13·7171	16·8039
41	172·24004	6303	9844	11·2501	14·0601	17·2240
42	176·44102	7677	6·1304	5245	4030	6441
43	180·64199	9050	2763	7989	7459	18·0642
44	184·84297	6·0423	4223	12·0733	15·0888	4843
45	189·04395	1796	5682	3477	4318	9044
46	193·24492	3170	7142	6221	7747	19·3245
47	197·44590	4543	8602	8965	16·1176	7446
48	201·64688	5916	7·0061	13·1709	4605	20·1647
49	205·84785	7289	1521	4453	8035	5848
50	210·04883	8663	2980	7197	17·1464	21·0049
51	214·24981	7·0036	4440	9941	4893	4250
52	218·45078	1409	5900	14·2685	8323	8451
53	222·65176	2782	7359	5429	18·1752	22·2652
54	226·85274	4156	8819	8173	5181	6853
55	231·05371	5529	8·0278	15·0917	8610	23·1054
56	235·25469	6902	1738	3661	19·2040	5255
57	239·45567	8276	3198	6405	5469	9456
58	243·65664	9649	4657	9148	8898	24·3657
59	247·85762	8·1022	6117	16·1892	20·2328	7858
60	252·05860	2395	7576	4636	5757	25·2059
61	256·25957	3769	9036	7380	9186	6260
62	260·46045	5142	9·0496	17·0124	21·2615	26·0461
63	264·66153	6515	1955	2868	6045	4662
64	268·86250	7888	3415	5612	9474	8863
65	273·06348	9262	4874	8356	22·2903	27·3063
66	277·26446	9·0635	6334	18·1100	6333	7264
67	281·46543	2008	7794	3844	9762	28·1465
68	285·66641	3381	9253	6588	23·3191	5666
69	289·86739	4755	10·0713	9332	6620	9867
70	294·06836	6128	2173	19·2076	24·0050	29·4068
71	298·26934	7501	3632	4820	3479	8269
72	302·47032	8874	5092	7564	6908	30·2470
73	306·67129	10·0248	6551	20·0308	25·0338	6671
74	310·87227	1621	8011	3051	3767	31·0872
75	315·07324	2994	9471	5795	7196	5073
76	319·27422	4367	11·0930	8539	26·0625	9274
77	323·47520	5741	2390	21·1283	4055	32·3475
78	327·67617	7114	3849	4027	7484	7676

TABLE LXXVd (1).—*continued.*

Weight of $BaSO_4$ obtained from 1 cm.^{3} of Vitriol or 1 grm. of Substance.	One Litre of Liquid contained of H_2SO_4.	100 Parts Original Substance corresponded to				
		S.	H_2S.	SO_2.	SO_3.	H_2SO_4.
Grms.						
0·79	331·87715	10·8487	11·5309	21·6771	27·0913	33·1877
80	336·07813	9860	6769	9515	4342	.6078
81	340·27910	11·1234	8228	22·2259	7772	34·0279
82	344·48008	2607	9688	5003	28·1201	4480
83	348·68106	3980	12·1147	7747	4630	8681
84	352·88203	5353	2607	23·0491	8060	35·2882
85	357·08301	6727	4067	3235	29·1489	7083
86	361·28399	8100	5526	5979	4918	36·1284
87	365·48496	9473	6986	8723	8347	5485
88	369·68594	12·0846	8445	24·1467	30·1777	9686
89	373·88692	2220	9905	4211	5206	37·3887
90	378·08789	3593	13·1365	6955	8635	8088
91	382·28887	4966	2824	9698	31·2065	38·2289
92	386·48985	6339	4284	25·2442	5494	6490
93	390·69082	7713	5744	5186	8923	39·0691
94	394·89180	9086	7203	7930	32·2352	4892
95	399·09278	13·0459	8663	26·0674	5782	9093
96	403·29375	1832	14·0122	3418	9211	40·3294
97	407·49473	3206	1582	6162	33·2640	7495
98	411·69571	4579	3042	8906	6070	41·1696
99	415·89668	5952	4501	27·1650	9499	5897
1·00	420·09766	7325	5961	4394	34·2928	42·0098
2	840·19532	27·4651	29·1922	54·8788	68·5856	84·0195
3	1260·29298	41·1976	43·7882	82·3182	102·8784	126·0293
4	1680·39064	54·9302	58 3843	109·7576	137·1712	168.0391
5	2100·48830	68·6627	72·9804	137·1970	171·4641	210·0488
6	2520·58596	82·3953	87·5765	164·6363	205·7569	252·0586
7	2940·68362	96·1278	102·1725	192·0757	240·0497	294·0684
8	3360·78128	109·8604	116·7686	219·5151	274·3125	336·0781
9	3780·87894	123·5929	131·3647	246·9545	308·6353	378·0879

One gramme of a substance yielded 2·4789 grms. $BaSO_4$: find the percentage of sulphur in the substance.

2	grms. ≡ 27·4651	per cent. S.	
·47	„ ≡ 6·4543	„	
·0089	„ ≡ ·1222	„	,
∴ 2·4789	≡ 34·0416	„	„

One centimetre cube of vitriol yielded 4·3697 grms. of $BaSO_4$: find the weight of H_2SO_4 in one litre of such vitriol.

4	grms. ≡ 1680·39064	grms. per litre.	
·36	„ ≡ 151·23516	„	„
·0097	„ ≡ 4·07495	„	„
∴ 4·3697	„ ≡ 1835·70075	„	„

TABLE LXXVd (2).—**For Analysis of Phosphates,** etc.

Weight of $Mg_2P_2O_7$ obtained from 1 grm. of Substance.	100 Parts Original Substance corresponded to				
	P.	P_2O_5.	$Ca_3(PO_4)_2$.	$Ca_2H_2(PO_4)_2$.	$CaH_4(PO_4)_2$.
0·01	0·2784	0·6376	1·3932	1·2222	1·0512
02	0·5568	1·2751	2·7865	2·4445	2·1025
03	0·8351	1·9127	4·1797	3·6667	3·1537
04	1·1135	2·5503	5·5729	4·8889	4·2050
05	1·3919	3·1879	6·9661	6·1112	5·2562
06	1·6703	3·8254	8·3594	7·3334	6·3074
07	1·9486	4·4630	9·7526	8·5556	7·3587
08	2·2270	5·1006	11·1458	9·7779	8·4099
09	2·5054	5·7381	12·5391	11·0001	9·4612
10	2·7838	6·3757	13·9323	12·2223	10·5124
11	3·0621	7·0133	15·3255	13·4446	11·5636
12	3·3405	7·6509	16·7187	14·6668	12·6149
13	3·6189	8·2884	18·1120	15·8890	13·6661
14	3·8973	8·9260	19·5052	17·1113	14·7173
15	4·1756	9·5636	20·8984	18·3335	15·7686
16	4·4540	10·2011	22·2917	19·5557	16·8198
17	4·7324	10·8387	23·6849	20·7780	17·8711
18	5·0108	11·4763	25·0781	22·0002	18·9223
19	5·2892	12·1139	26·4714	23·2224	19·9735
20	5·5675	12·7514	27·8646	24·4447	21·0248
21	5·8459	13·3890	29·2578	25·6669	22·0760
22	6·1243	14·0266	30·6510	26·8892	23·1273
23	6·4027	14·6642	32·0443	28·1114	24·1785
24	6·6810	15·3017	33·4375	29·3336	25·2297
25	6·9594	15·9393	34·8307	30·5559	26·2810
26	7·2378	16·5769	36·2240	31·7781	27·3322
27	7·5162	17·2144	37·6172	33·0003	28·3835
28	7·7945	17·8520	39·0104	34·2226	29·4347
29	8·0729	18·4896	40·4036	35·4448	30·4859
30	8·3513	19·1272	41·7969	36·6670	31·5372
31	8·6297	19·7647	43·1901	37·8892	32·5884
32	8·9080	20·4023	44·5833	39·1115	33·6397
33	9·1864	21·0399	45·9766	40·3337	34·6909
34	9·4648	21·6774	47·3698	41·5560	35·7421
35	9·7432	22·3150	48·7640	42·7782	36·7934
36	10·0216	22·9526	50·1562	44·0004	37·8446
37	10·2999	23·5902	51·5495	45·2227	38·8959
38	10·5783	24·2277	52·9427	46·4449	40·9471
39	10·8567	24·8653	54·3359	47·6671	41·9983
40	11·1351	25·5029	55·7292	48·8894	42·0496
41	11·4134	26·1404	57·1224	50·1116	43·1008
42	11·6918	26·7780	58·5156	51·3338	44·1520
43	11·9702	27·4156	59·9089	52·5561	45·2033

TABLE LXXVD (2).—*continued.*

Weight of $Mg_2P_2O_7$ obtained from 1 grm. of Substance.	100 Parts Original Substance corresponded to				
	P.	P_2O_5.	$Ca_3(PO_4)_2$.	$Ca_2H_2(PO_4)_2$.	$CaH_4(PO_4)_2$.
0·44	12·2486	28·0532	61·3021	53·7783	46·2545
45	12·5269	28·6907	62·6953	55·0005	47·3058
46	12·8053	29·3283	64·0885	56·2228	48·3570
47	13·0837	29·9659	65·4818	57·4450	49·4082
48	13·3621	30·6034	66·8750	58·6672	50·4595
49	13·6404	31·2410	68.2682	59·8895	51·5107
50	13·9188	31·8786	69·6615	61·1117	52·5620
51	14·1972	32·5162	71·0547	62·3339	53·6132
52	14·4756	33·1537	72·4479	63·5562	54·6644
53	14·7540	33·7913	73·8411	64·7784	55·7157
54	15·0323	34·4289	75·2344	66·0006	56·7669
55	15·3107	35·0665	76·6276	67·2229	57·8182
56	15·5891	35·7040	78·0208	68·4451	58·8694
57	15·8675	36·3416	79·4141	69·6673	59·9206
58	16·1458	36·9792	80·8073	70·8896	60·9719
59	16·4242	37·6167	82·2005	72·1118	62·0231
60	16·7026	38·2543	83·5937	73·3341	63·0744
61	16·9810	38·8919	84·9870	74·5563	64·1256
62	17·2593	39·5295	86·3802	75·7785	65·1768
63	17·5377	40·1670	87·7734	77·0008	66·2281
64	17·8161	40·8046	89·1667	78·2230	67·2793
65	18·0945	41·4422	90·5599	79·4452	68·3305
66	18·3728	42·0797	91·9531	80·6675	69·3818
67	18·6512	42·7173	93·3464	81·8897	70·4330
68	18·9296	43·3549	94·7396	83·1119	71·4843
69	19·2080	43·9925	96·1328	84·3342	72·5355
70	19·4864	44·6300	97·5260	85·5564	73·5867
71	19·7647	45·2676	98·9193	86·7786	74·6380
72	20·0431	45·9052	100·3125	88·0009	75·6892
73	20·3215	46·5427	101·7057	89·2231	76·7405
74	20·5999	47·1803	103·0990	90·4453	77·7917
75	20·8782	47·8179	104·4922	91·6676	78·8429
76	21·1566	48·4555	105·8854	92·8898	79·8942
77	21·4350	49·0930	107·2786	94·1120	80·9454
78	21·7134	49·7306	108·6719	95·3343	81·9967
79	21·9917	50·3682	110·0651	96·5565	83·0479
80	22·2701	51·0057	111·4583	97·7787	84·0991
81	22·5485	51·6433	112·8516	99·0010	85·1504
82	22·8269	52·2809	114·2448	100·2232	86·2016
83	23·1052	52·9185	115·6380	101·4454	87·2529
84	23·3836	53·5560	117·0312	102·6677	88·3041
85	23·6620	54·1936	118·4245	103·8899	89·3553
86	23·9404	54·8312	119·8177	105·1121	90·4066

TABLE LXXVD (2).—*continued.*

Weight of $Mg_2P_2O_7$ obtained from 1 grm. of Substance.	100 Parts Original Substance corresponded to				
	P.	P_2O_5.	$Ca_3(PO_4)_2$.	$Ca_2H_2(PO_4)_2$.	$CaH_4(PO_4)_2$.
·87	24·2188	55·4688	121·2109	106·3344	91·4578
88	24·4971	56·1063	122·6042	107·5566	92·5091
89	24·7755	56·7439	123·9974	108·7788	93·5603
90	25·0539	57·3815	125·3906	110·0011	94·6115
91	25·3323	58·0190	126·7839	111·2233	95·6628
92	25·6106	58·6566	128·1771	112·4455	96·7140
93	25·8890	59·2942	129·5703	113·6678	97·7652
94	26·1674	59·9318	130·9635	114·8900	98·8165
95	26·4458	60·5693	132·3568	116·1122	99·8677
96	26·7241	61·2069	133·7500	117·3345	100·9190
97	27·0025	61·8445	135·1432	118·5567	101·9702
98	27·2809	62·4820	136·5365	119·7790	103·0214
99	27·5593	63·1196	137·9297	121·0012	104·0727
1·00	27·8376	63·7572	139·3229	122·2234	105·1239
2	55·6753	127·5144	278·6458	244·4468	210·2478
3	83·5129	191·2716	417·9687	366·6703	315·3718
4	111·3506	255·0287	557·2917	488·8937	420·4957
5	139·1882	318·7859	696·6146	611·1171	525·6196
6	167·0259	382·5431	835·9375	733·3405	630·7435
7	194·8635	446·3003	975·2604	855·5639	735·8674
8	222·7011	510·0575	1114·5833	977·7874	840·9914
9	250·5388	573·8147	1253·9062	1100·0108	946·1153

This table enables one to get at once, by simple addition, the percentage of P, P_2O_5, etc., in a sample of manure or other phosphatic material: *e.g.* a gramme of a mineral yielded 0·6978 grm. of $Mg_2P_2O_7$; find the percentage of P_2O_5 in the substance

0·69	grm. $Mg_2P_2O_7$ corresponds to	43·9925	per cent. P_2O_5.
·0078	„ „ „	·4973	„ „
∴ 0·6978	„ „ „	44·4898	„ „

One gramme of a phosphide yielded, on oxidation and precipitation, 2·7695 grm. of $Mg_2P_2O_7$; find the percentage of phosphorus in the sample

2·	grms. of $Mg_2P_2O_7$ corresponds to	55·6753	per cent. of P.
·76	„ „ „	21·1566	„ „
·0095	„ „ „	·2645	„ „
	∴ Percentage of P in the phosphide =	77·0964	„ „

Percentage determinations can only be reliable to the second place of decimals in most cases.

TABLE LXXVD (3).—Assay Table.

(*a*) Giving weight per ton (in Troy weight) of metal corresponding to weight of metal per 100,000 parts of assay.

Pts. per 100,000.	Weight of Metal per Ton (Av.).			Pts. per 100,000.	Weight of Metal per Ton (Av.).			Pts. per 100,000.	Weight of Metal per Ton (Av.).			Pts. per 100,000.	Weight of Metal per Ton (Av.).		
	oz.	dwts.	grs.		oz.	dwts.	grs.		oz.	dwts.	grs.		oz.	dwts.	grs.
0·1	0	0	15·68	30	9	16	0·0	68	22	4	6·4	106	34	12	12·8
0·2	0	1	7·36	31	10	2	12·8	69	22	10	19·2	107	34	19	1·6
0·3	0	1	23·04	32	10	9	1·6	70	22	17	8·0	108	35	5	14·4
0·4	0	2	14·72	33	10	15	14·4	71	23	3	20·8	109	35	12	3·2
0·5	0	3	6·40	34	11	2	3·2	72	23	10	9·6	110	35	18	16·0
0·6	0	3	22·08	35	11	8	16·0	73	23	16	22·4	111	36	5	4·8
0·7	0	4	13·76	36	11	15	4·8	74	24	3	11·2	112	36	11	17·6
0·8	0	5	5·44	37	12	1	17 6	75	24	10	0·0	113	36	18	6·4
0·9	0	5	21·12	38	12	8	6·4	76	24	16	12·8	114	37	4	19·2
1	0	6	12·80	39	12	14	19·2	77	25	3	1·6	115	37	11	8·0
2	0	13	1·6	40	13	1	8·0	78	25	9	14·4	116	37	17	20·8
3	0	19	14·4	41	13	7	20·8	79	25	16	3·2	117	38	4	9·6
4	1	6	3·2	42	13	14	9·6	80	26	2	16·0	118	38	10	22·4
5	1	12	16·0	43	14	0	22·4	81	26	9	4·8	119	38	17	11·2
6	1	19	4·8	44	14	7	11·2	82	26	15	17·6	120	39	4	0·0
7	2	5	17·6	45	14	14	0·0	83	27	2	6·4	121	39	10	12·8
8	2	12	6·4	46	15	0	12·8	84	27	8	19·2	122	39	17	1·6
9	2	18	19·2	47	15	7	1·6	85	27	15	8·0	123	40	3	14·4
10	3	5	8·0	48	15	13	14·4	86	28	1	20·8	124	40	10	3·2
11	3	11	20·8	49	16	0	3·2	87	28	8	9·6	125	40	16	16·0
12	3	18	9·6	50	16	6	16·0	88	28	14	22·4	126	41	3	4·8
13	4	4	22·4	51	16	13	4·8	89	29	1	11·2	127	41	9	17·6
14	4	11	11·2	52	16	19	17·6	90	29	8	0·0	128	41	16	6·4
15	4	18	0·0	53	17	6	6·4	91	29	14	12·8	129	42	2	19·2
16	5	4	12·8	54	17	12	19·2	92	30	1	1·6	130	42	9	8·0
17	5	11	1·6	55	17	19	8·0	93	30	7	14·4	131	42	15	20·8
18	5	17	14·4	56	18	5	20·8	94	30	14	3·2	132	43	2	9·6
19	6	4	3·2	57	18	12	9·6	95	31	0	16·0	133	43	8	22·4
20	6	10	16·0	58	18	18	22·4	96	31	7	1·8	134	43	15	11·2
21	6	17	4·8	59	19	5	11·2	97	31	13	17·6	135	44	2	0·0
22	7	3	17·6	60	19	12	0·0	98	32	0	6·4	136	44	8	12·8
23	7	10	6·4	61	19	18	12·8	99	32	6	19·2	137	44	15	1·6
24	7	16	19·2	62	20	5	1·6	100	32	13	8·0	138	45	1	14·4
25	8	3	8·0	63	20	11	14·4	101	32	19	20·8	139	45	8	3·2
26	8	9	20·8	64	20	18	3·2	102	33	6	9·6	140	45	14	16·0
27	8	16	9·6	65	21	4	16·0	103	33	12	22·4	141	46	1	4·8
28	9	2	22·4	66	21	11	4·8	104	33	19	11·2	142	46	7	17·6
29	9	9	11·2	67	21	17	17·6	105	34	6	0·0	143	46	14	6·4

TABLE LXXVD (3).—*continued.*

Pts. per 100,000.	Weight of Metal per Ton (Av.). oz.	dwts.	grs.	Pts. per 100,000.	Weight of Metal per Ton (Av.). oz.	dwts.	grs.	Pts. per 100,000.	Weight of Metal per Ton (Av.). oz.	dwts.	grs.	Pts. per 100,000.	Weight of Metal per Ton (Av.). oz.	dwts.	grs.
144	47	0	19·2	184	60	2	3·2	224	73	3	11·2	264	86	4	19·2
145	47	7	8·0	185	60	8	16·0	225	73	10	0·0	265	86	11	8·0
146	47	13	20·8	186	60	15	4·8	226	73	16	12·8	266	86	17	20·8
147	48	0	9·6	187	61	1	17·6	227	74	3	1·6	267	87	4	9·6
148	48	6	22·4	188	61	8	6·4	228	74	9	14·4	268	87	10	22·4
149	48	13	11·2	189	61	14	19·2	229	74	16	3·2	269	87	17	11·2
150	49	0	0·0	190	62	1	8·0	230	75	2	16·0	270	88	4	0·0
151	49	6	12·8	191	62	7	20·8	231	75	9	4·8	271	88	10	12·8
152	49	13	1·6	192	62	14	9·6	232	75	15	17·6	272	88	17	1·6
153	49	19	14·4	193	63	0	22·4	233	76	2	6·4	273	89	3	14·4
154	50	6	3·2	194	63	7	11·2	234	76	8	19·2	274	89	10	3·2
155	50	12	16·0	195	63	14	0·0	235	76	15	8·0	275	89	16	16·0
156	50	19	4·8	196	64	0	12·8	236	77	1	20·8	276	90	3	4·8
157	51	5	17·6	197	64	7	1·6	237	77	8	9·6	277	90	9	17·6
158	51	12	6·4	198	64	13	14·4	238	77	14	22·4	278	90	16	6·4
159	51	18	19·2	199	65	0	3·2	239	78	1	11·2	279	91	2	19·2
160	52	5	8·0	200	65	6	16·0	240	78	8	0·0	280	91	9	8·0
161	52	11	20·8	201	65	13	4·8	241	78	14	12·8	281	91	15	20·8
162	52	18	9·6	202	65	19	17·6	242	79	1	1·6	282	92	2	9·6
163	53	4	22·4	203	66	6	6·4	243	79	7	14·4	283	92	8	22·4
164	53	11	11·2	204	66	12	19·2	244	79	14	3·2	284	92	15	11·2
165	53	18	0·0	205	66	19	8·0	245	80	0	16·0	285	93	2	0·0
166	54	4	12·8	206	67	5	20·8	246	80	7	4·8	286	93	8	12·8
167	54	11	1·6	207	67	12	9·6	247	80	13	17·6	287	93	15	1·6
168	54	17	14·4	208	67	18	22·4	248	81	0	6·4	288	94	1	14·4
169	55	4	3·2	209	68	5	11·2	249	81	6	19·2	289	94	8	3·2
170	55	10	16·0	210	68	12	0·0	250	81	13	8·0	290	94	14	16·0
171	55	17	4·8	211	68	18	12·8	251	81	19	20·8	291	95	1	4·8
172	56	3	17·6	212	69	5	1·6	252	82	6	9·6	292	95	7	17·6
173	56	10	6·4	213	69	11	14·4	253	82	12	22·4	293	95	14	6·4
174	56	16	19·2	214	69	18	3·2	254	82	19	11·2	294	96	0	19·2
175	57	3	8·0	215	70	4	16·0	255	83	6	0·0	295	96	7	8·0
176	57	9	20·8	216	70	11	4·8	256	83	12	12·8	296	96	13	20·8
177	57	16	9·6	217	70	17	17·6	257	83	19	1·6	297	97	0	9·6
178	58	2	22·4	218	71	4	6·4	258	84	5	14·4	298	97	6	22·4
179	58	9	11·2	219	71	10	19·2	259	84	12	3·2	299	97	13	11·2
180	58	16	0·0	220	71	17	8·0	260	84	18	16·0	300	98	0	0·0
181	59	2	12·8	221	72	3	20·8	261	85	5	4·8	301	98	6	12·8
182	59	9	1·6	222	72	10	9·6	262	85	11	17·6	302	98	13	1·6
183	59	15	14·4	223	72	16	22·4	263	85	18	6·4	303	98	19	14·4

TABLE LXXVD (3).—*continued.*

Pts. per 100,000.	Weight of Metal per Ton (Av.).			Pts. per 100,000.	Weight of Metal per Ton (Av.).			Pts. per 100,000.	Weight of Metal per Ton (Av.).			Pts. per 100,000.	Weight of Metal per Ton (Av.).		
	oz.	dwts.	grs.		oz.	dwts.	grs.		oz.	dwts.	grs.		oz.	dwts.	grs.
304	99	6	3·2	344	112	7	11·2	384	125	8	19·2	424	138	10	3·2
305	99	12	16·0	345	112	14	0·0	385	125	15	8·0	425	138	16	16·0
306	99	19	4·8	346	113	0	12·8	386	126	1	20·8	426	139	3	4·8
307	100	5	17·6	347	113	7	1·6	387	126	8	9·6	427	139	9	17·6
308	100	12	6·4	348	113	13	14·4	388	126	14	22·4	428	139	16	6·4
309	100	18	19·2	349	114	0	3·2	389	127	1	11·2	429	140	2	19·2
310	101	5	8·0	350	114	6	16·0	390	127	8	0·0	430	140	9	8·0
311	101	11	20·8	351	114	13	4·8	391	127	14	12·8	431	140	15	20·8
312	101	18	9·6	352	114	19	17·6	392	128	1	1·6	432	141	2	9·6
313	102	4	22·4	353	115	6	6·4	393	128	7	14·4	433	141	8	22·4
314	102	11	11·2	354	115	12	19·2	394	128	14	3·2	434	141	15	11·2
315	102	18	0·0	355	115	19	8·0	395	129	0	16·0	435	142	2	0·0
316	103	4	12·8	356	116	5	20·8	396	129	7	4·8	436	142	8	12·8
317	103	11	1·6	357	116	12	9·6	397	129	13	17·6	437	142	15	1·6
318	103	17	14·4	358	116	18	22·4	398	130	0	6·4	438	143	1	14·4
319	104	4	3·2	359	117	5	11·2	399	130	6	19·2	439	143	8	3·2
320	104	10	16·0	360	117	12	0·0	400	130	13	8·0	440	143	14	16·0
321	104	17	4·8	361	117	18	12·8	401	130	19	20·8	441	144	1	4·8
322	105	3	17·6	362	118	5	1·6	402	131	6	9·6	442	144	7	17·6
323	105	10	6·4	363	118	11	14·4	403	131	12	22·4	443	144	14	6·4
324	105	16	19·2	364	118	18	3·2	404	131	19	11·2	444	145	0	19·2
325	106	3	8·0	365	119	4	16·0	405	132	6	0·0	445	145	7	8·0
326	106	9	20·8	366	119	11	4·8	406	132	12	12·8	446	145	13	20·8
327	106	16	9·6	367	119	17	17·6	407	132	19	1·6	447	146	0	9·6
328	107	2	22·4	368	120	4	6·4	408	133	5	14·4	448	146	6	22·4
329	107	9	11·2	369	120	10	19·2	409	133	12	3·2	449	146	13	11·2
330	107	16	0·0	370	120	17	8·0	410	133	18	16·0	450	147	0	0·0
331	108	2	12·8	371	121	3	20·8	411	134	5	4·8	451	147	6	12·8
332	108	9	1·6	372	121	10	9·6	412	134	11	17·6	452	147	13	1·6
333	108	15	14·4	373	121	16	22·4	413	134	18	6·4	453	147	19	14·4
334	109	2	3·2	374	122	3	11·2	414	135	4	19·2	454	148	6	3·2
335	109	8	16·0	375	122	10	0·0	415	135	11	8·0	455	148	12	16·0
336	109	15	4·8	376	122	16	12·8	416	135	17	20·8	456	148	19	4·8
337	110	1	17·6	377	123	3	1·6	417	136	4	9·6	457	149	5	17·6
338	110	8	6·4	378	123	9	14·4	418	136	10	22·4	458	149	12	6·4
339	110	14	19·2	379	123	16	3·2	419	136	17	11·2	459	149	18	19·2
340	111	1	8·0	380	124	2	16·0	420	137	4	0·0	460	150	5	8·0
341	111	7	20·8	381	124	9	4·8	421	137	10	12·8	461	150	11	20·8
342	111	14	9·6	382	124	15	17·6	422	137	17	1·6	462	150	18	9·6
343	112	0	22·4	383	125	2	6·4	423	138	3	14·4	463	151	4	22·4

TABLE LXXVD (3).—*continued.*

Pts. per 100,000.	Weight of Metal per Ton (Av.).			Pts. per 100,000.	Weight of Metal per Ton (Av.).			Pts. per 100,000.	Weight of Metal per Ton (Av.).			Pts. per 100,000.	Weight of Metal per Ton (Av.).		
	oz.	dwts.	grs.		oz.	dwts.	grs.		oz.	dwts.	grs.		oz.	dwts.	grs.
464	151	11	11·2	485	158	8	16·0	6000	1960	0	0	0·0007	0	0	0·110
465	151	18	0·0	486	158	15	4·8	7000	2286	13	8	·0008	0	0	0·125
466	152	4	12·8	487	159	1	17·6	8000	2613	6	16	·0009	0	0	0·141
467	152	11	1·6	488	159	8	6·4	9000	2940	0	6	·001	0	0	0·157
468	152	17	14·4	489	159	14	19·2	10000	3266	13	8	·002	0	0	0·314
469	153	4	3·2	490	160	1	8·0	20000	6533	6	16	·003	0	0	0·470
470	153	10	16·0	491	160	7	20·8	30000	9800	0	0	·004	0	0	0·627
471	153	17	4·8	492	160	14	9·6	40000	13066	13	8	·005	0	0	0·784
472	154	3	17·6	493	161	0	22·4	50000	16333	6	16	·006	0	0	0·941
473	154	10	6·4	494	161	7	11·2	60000	19600	0	0	·007	0	0	1·098
474	154	16	19·2	495	161	14	0·0	70000	22866	13	8	·008	0	0	1·254
475	155	3	8·0	496	162	0	12·8	80000	26133	6	16	·009	0	0	1·411
476	155	9	20·8	497	162	7	1·6	90000	29400	0	0	·01	0	0	1·568
477	155	16	9·6	498	162	13	14·4					·02	0	0	3·136
478	156	2	22·4	499	163	0	3·2					·03	0	0	4·704
479	156	9	11·2	500	163	6	16·0	0·0001	0	0	0·016	·04	0	0	6·272
480	156	16	0·0	1000	326	13	8·0	·0002	0	0	0·031	·05	0	0	7·840
481	157	2	12·8	2000	653	6	16·0	·0003	0	0	0·047	·06	0	0	9·408
482	157	9	1·6	3000	980	0	0	·0004	0	0	0·063	·07	0	0	10·976
483	157	15	14·4	4000	1306	13	8	·0005	0	0	0·078	·08	0	0	12·544
484	158	2	3·2	5000	1633	6	16	·0006	0	0	0·094	·09	0	0	14·112

Gold Assay Table.

(*b*) Giving Bank and Mint Values of Fine Gold per Ton Avoirdupois of Ore, etc.

Weight of Fine Gold per Ton.	Value of Gold in 1 Ton Avoir.						Weight of Fine Gold per Ton.	Value of Gold in 1 Ton Avoir.					
	Mint Value.			Bank Value.				Mint Value.			Bank Value.		
grs.	£	*s.*	*d.*	£	*s.*	*d.*	grs.	£	*s.*	*d.*	£	*s.*	*d.*
1	0	0	2·124	0	0	2·120	9	0	1	7·115	0	1	7·084
2	0	0	4·248	0	0	4·241	10	0	1	9·239	0	1	9·205
3	0	0	6·372	0	0	6·361	11	0	1	11·363	0	1	11·325
4	0	0	8·495	0	0	8·482	12	0	2	1·486	0	2	1·445
5	0	0	10·619	0	0	10·602	13	0	2	3·610	0	2	3·566
6	0	1	0·743	0	1	0·723	14	0	2	5·734	0	2	5·686
7	0	1	2·867	0	1	2·843	15	0	2	7·858	0	2	7·807
8	0	1	4·991	0	1	4·964	16	0	2	9·982	0	2	9·927

TABLE LXXVD (3).—*continued.*

Gold Assay Table.—*continued.*

Weight of Fine Gold per Ton.	Value of Gold in 1 Ton Avoir.					
	Mint Value.			Bank Value.		
grs.	£	s.	d.	£	s.	d.
17	0	3	0·106	0	3	0·048
18	0	3	2·230	0	3	2·168
19	0	3	4·353	0	3	4·289
20	0	3	6·477	0	3	6·409
21	0	3	8·601	0	3	8·530
22	0	3	10·725	0	3	10·650
23	0	4	0·849	0	4	0·770
dwts.						
1	0	4	2·972	0	4	2·890
2	0	8	5·945	0	8	5·781
3	0	12	8·918	0	12	8·672
4	0	16	11·890	0	16	11·563
5	1	1	2·863	1	1	2·454
6	1	5	5·836	1	5	5·345
7	1	9	8·809	1	9	8·236
8	1	13	11·781	1	13	11·127
9	1	18	2·754	1	18	2·018
10	2	2	5·727	2	2	4·909
11	2	6	8·700	2	6	7·800
12	2	10	11·672	2	10	10·690
13	2	15	2·645	2	15	1·581
14	2	19	5·618	2	19	4·472
15	3	3	8·590	3	3	7·363
16	3	7	11·563	3	7	10·254
17	3	12	2·536	3	12	1·145
18	3	16	5·509	3	16	4·036
19	4	0	8·481	4	0	6·927
oz.						
1	4	4	11·45	4	4	9·81
2	8	9	10·90	8	9	7·63
3	12	14	10·36	12	14	5·45
4	16	19	9·81	16	19	3·27
5	21	4	9·27	21	4	1·09
6	25	9	8·72	25	8	10·90

Weight of Fine Gold per Ton.	Value of Gold in 1 Ton Avoir.					
	Mint Value.			Bank Value.		
oz.	£	s.	d.	£	s.	d.
7	29	14	8·18	29	13	8·72
8	33	19	7·63	33	18	6·54
9	38	4	7·09	38	3	4·36
10	42	9	6·54	42	8	2·18
20	84	19	1·09	84	16	4·36
30	127	8	7·63	127	4	6·54
40	169	18	2·18	169	12	8·72
50	212	7	8·72	212	0	10·90
60	254	17	3·27	254	9	1·09
70	297	6	9·81	296	17	3·27
80	339	16	4·36	339	5	5·45
90	382	5	10·90	381	13	7·63
100	424	15	5·45	424	1	9·81
200	849	10	10·90	848	3	7·63
300	1274	6	4·36	1272	5	5·45
400	1699	1	9·81	1696	7	3·27
500	2123	17	3·27	2120	9	1·09
600	2548	12	8·72	2544	10	10·90
700	2973	8	2·18	2968	12	8·72
800	3398	3	7·63	3392	14	6·54
900	3821	19	1·09	3816	16	4·36
1000	4247	14	6·54	4240	18	2·18
2000	8495	9	1·09	8481	16	4·36
3000	12743	3	7·63	12722	14	6·54
4000	16990	18	2·18	16963	12	8·72
5000	21238	12	8·72	21204	10	10·90
6000	25486	7	3·27	25445	9	1·09
7000	29734	1	9·81	29686	7	3·27
8000	33981	16	4·36	33927	5	5·45
9000	38229	10	10·90	38168	3	7·63
10000	42477	5	5·45	42409	1	9·81
20000	84954	11	10·90	84818	3	7·63
30000	127431	17	4·36	127227	5	5·45

The mint value per ton of gold in an ore yielding 28 oz., 12 dwts. 18·75 grs. found thus:—

20 oz.	corresponds to	£84	19	1·091		
8 ,,	,, ,,	33	19	7·636		
12 dwts.	,, ,,	2	10	11·673	= £121	13 0·223.
18 grs.	,, ,,	0	3	2·230		
·7 grs.	,, ,,	0	0	1·487		
·05 ,,	,, ,,	0	0	0·106		

TABLE LXXVD (3).—*continued.*

Gold Assay Table.

(*c*) Giving Bank and Mint Values of Fine Gold per Ton Avoirdupois of Ore or Alloy.

Percentage of Fine Gold.	Value of Gold in 1 Ton Avoir.						Percentage of Fine Gold.	Value of Gold in 1 Ton Avoir.					
	Mint Value.			Bank Value.				Mint Value.			Bank Value.		
	£	s.	d.	£	s.	d.		£	s.	d.	£	s.	d.
0·00001	0	0	3·330	0	0	3·325	0·06	83	5	1·309	83	2	5·236
·00002	0	0	6·660	0	0	6·650	·07	97	2	7·527	96	19	6·109
·00003	0	0	9·991	0	0	9·975	·08	111	0	1·745	110	16	6·981
·00004	0	1	1·321	0	1	1·299	·09	124	17	7·963	124	13	7·854
·00005	0	1	4·651	0	1	4·624	·1	138	15	2·18	138	10	8·72
·00006	0	1	7·981	0	1	7·949	·2	277	10	4·36	277	1	5·45
·00007	0	1	11·312	0	1	11·274	·3	416	5	6·54	415	12	2·18
·00008	0	2	2·642	0	2	2·599	·4	555	0	8·72	554	2	10·90
·00009	0	2	5·972	0	2	5·924	·5	693	15	10·90	692	13	7·63
·0001	0	2	9·302	0	2	9·249	·6	832	11	1·09	831	4	4·36
·0002	0	5	6·604	0	5	6·497	·7	971	6	3·27	969	15	1·09
·0003	0	8	3·907	0	8	3·746	·8	1110	1	5·45	1108	5	9·81
·0004	0	11	1·209	0	11	0·995	·9	1248	16	7·63	1246	16	6·54
·0005	0	13	10·511	0	13	10·214	1	1387	11	9·81	1385	7	3·27
·0006	0	16	7·813	0	16	7·492	2	2775	3	7·63	2770	14	6·54
·0007	0	19	5·115	0	19	4·711	3	4162	15	5·45	4156	1	9·81
·0008	1	2	2·417	1	2	1·990	4	5550	7	3·27	5541	9	1·09
·0009	1	4	11·720	1	4	11·239	5	6937	19	1·09	6926	16	4·36
·001	1	7	9·022	1	7	8·487	6	8325	10	10·90	8312	3	7·63
·002	2	15	6·043	2	15	4·975	7	9713	2	8·72	9697	10	10·90
·003	4	3	3·065	4	3	1·462	8	11100	14	6·54	11082	18	2·18
·004	5	11	0·087	5	10	9·949	9	12488	6	4·36	12468	5	5·45
·005	6	18	9·109	6	18	6·436	10	13875	18	2·18	13853	12	8·72
·006	8	6	6·131	8	6	2·924	20	27751	16	4·36	27707	5	5·45
·007	9	14	3·153	9	13	11·411	30	41627	14	6·54	41560	18	2·18
·008	11	2	0·175	11	1	7·898	40	55503	12	8·72	55414	10	10·90
·009	12	9	9·196	12	9	4·385	50	69379	10	10·90	69268	3	7·63
·01	13	17	6·218	13	17	0·873	60	83255	9	1·09	83121	16	4·36
·02	27	15	0·436	27	14	1·745	70	97131	7	3·27	96975	9	1·09
·03	41	12	6·654	41	11	2·618	80	111007	5	5·45	110829	1	9·81
·04	55	10	0·872	55	8	3·490	90	124883	3	7·63	124682	14	6·54
·05	69	7	7·090	69	5	4·363	100	138759	1	9·81	138536	7	3·27

Supposing a mineral yielded 0·007858 per cent. of fine gold, then the value of gold per ton of mineral is found as follows:—

0·007 corresponds to		£9	14	3·153
·0008	,, ,,	1	2	2·417
·00005	,, ,,	0	1	4·651
·000006	,, ,,	0	0	1·998
Therefore 0·007856	,, ,,	£10	18	0·219

TABLE LXXVD (3).—Gold Assay Table.

(*d*) Carat Gold, with corresponding Weights and Values.

Carat Gold.			Weight of fine Gold per oz.			Mint Value of Gold.			Carat Gold.			Weight of fine Gold per oz.			Mint Value of Gold.		
Ct.	Ct. gr.	Eighths.	oz.	dwts.	grs.	£	s.	d.	Ct.	Ct. gr.	Eighths.	oz.	dwts.	grs.	£	s.	d.
0	0	1	0	0	0·625	0	0	1·3274	8	0	0	0	6	16	1	8	3·81
0	0	2	0	0	1·250	0	0	2·6548	9	0	0	0	7	12	1	11	10·2954
0	0	3	0	0	1·875	0	0	3·9822	10	0	0	0	8	8	1	15	3·772
0	0	4	0	0	2·500	0	0	5·3097	11	0	0	0	9	4	1	18	11·25
0	0	5	0	0	3·125	0	0	6·6371	12	0	0	0	10	0	2	2	5·72
0	0	6	0	0	3·750	0	0	7·9645	13	0	0	0	10	20	2	6	0·2045
0	0	7	0	0	4·375	0	0	9·2919	14	0	0	0	11	16	2	9	6·681
0	1	0	0	0	5·000	0	0	10·6193	15	0	0	0	12	12	2	13	1·1590
0	2	0	0	0	10	0	1	9·2386	16	0	0	0	13	8	2	16	7·63
0	3	0	0	0	15	0	2	7·8580	17	0	0	0	14	4	3	0	2·1136
1	0	0	0	0	20	0	3	6·4772	18	0	0	0	15	0	3	3	8·490
2	0	0	0	1	16	0	7	0·9545	19	0	0	0	15	20	3	7	3·0681
3	0	0	0	2	12	0	10	7·4318	20	0	0	0	16	6	3	10	9·54
4	0	0	0	3	8	0	14	1·90	21	0	0	0	17	12	3	14	4·0227
5	0	0	0	4	4	0	17	8·3863	22	0	0	0	18	8	3	17	10·5
6	0	0	0	5	0	1	1	2·863	23	0	0	0	19	4	4	1	4·9772
7	0	0	0	5	20	1	4	9·3409	24	0	0	1	0	0	4	4	11·45

Gold per 1000 parts.	Carat Gold.			Fine Gold per oz.		Mint Value.		
	Ct.	Ct. gr.	Eighths.	dwts.	grs.	£	s.	d.
1	0	0	0·768	0	0·48	0	0	1·01945
2	0	0	1·536	0	0·96	0	0	2·03890
3	0	0	2·304	0	1·44	0	0	3·05836
4	0	0	3·072	0	1·92	0	0	4·07781
5	0	0	3·840	0	2·40	0	0	5·09727
6	0	0	4·608	0	2·88	0	0	6·11672
7	0	0	5·376	0	3·36	0	0	7·13618
8	0	0	6·144	0	3·84	0	0	8·15563
9	0	0	6·912	0	3·32	0	0	9·17509
10	0	0	7·68	0	4·80	0	0	10·1945
20	0	1	7·36	0	9·6	0	1	8·3890
30	0	2	7·04	0	14·4	0	2	6·5836
40	0	3	6·72	0	19·2	0	3	4·7781
50	1	0	6·40	1	0	0	4	2·9727
60	1	1	6·08	1	4·8	0	5	1·1672
70	1	2	5·76	1	9·6	0	5	11·3618
80	1	3	5·44	1	14·4	0	6	9·5563
90	2	0	5·12	1	19·2	0	7	7·7509
100	2	1	4·80	2	0	0	8	5·945
200	4	3	1·6	4	0	0	16	11·890
300	7	0	6·4	6	0	1	5	5·836
400	9	2	3·2	8	0	1	13	11·781
500	12	0	0	10	0	2	2	5·727
600	14	1	4·8	12	0	2	10	11·672
700	16	3	1·6	14	0	2	19	5·618
800	19	0	6·4	16	0	3	7	11·563
900	21	2	3·2	18	0	3	16	5·509

TABLE LXXVE (1).—Percentage of Na_2CO_3 in a mixture of Na_2CO_3 and K_2CO_3.

1 grm. $K_2CO_3 \equiv 144{\cdot}61316$ c.cms. $\frac{N}{10}$ acid; 1 grm. $Na_2CO_3 \equiv 188{\cdot}50141$ c.cms. $\frac{N}{10}$ acid.

If V = volume in c.cms. of $\frac{N}{10}$ acid used, then :—

$$\text{Percentage of } Na_2CO_3 \text{ in mixture} = (V - 144{\cdot}61316) \times 2{\cdot}278514.$$

A difference of 0·01 c.cm. in V makes a difference of 0·0228 in the percentage of Na_2CO_3: in no case, then, can we rely on more than two places of decimals in the percentages.

V = c.cms. of $\frac{N}{10}$ acid corresponding to 1 grm.	Tenths of a cm. Cube.									
	·0	·1	·2	·3	·4	·5	·6	·7	·8	·9
144	*	*	*	*	*	*	*	0·20	0·43	0·65
145	0·88	1·11	1·34	1·56	1·79	2·02	2·25	2·48	2·70	2·93
146	3·16	3·39	3·62	3·84	4·07	4·30	4·53	4·75	4·98	5·21
147	5·44	5·67	5·89	6·12	6·35	6·58	6·81	7·03	7·26	7·49
148	7·72	7·94	8·17	8·40	8·63	8·86	9·08	9·31	9·54	9·77
149	10·00	10·22	10·15	10·68	10·91	11·13	11·36	11·59	11·82	12·05
150	12·27	12·50	12·73	12·96	13·19	13·41	13·64	13·87	14·10	14·33
151	14·55	14·78	15·01	15·21	15·46	15·69	15·92	16·11	16·37	16·60
152	16·83	17·06	17·29	17·51	17·74	17·97	18·20	18·43	18·65	18·88
153	19·11	19·34	19·57	19·79	20·02	20·25	20·48	20·70	20·93	21·16
154	21·39	21·62	21·84	22·07	22·30	22·53	22·76	22·98	23·21	23·44
155	23·67	23·89	24·12	24·35	24·58	24·81	25·03	25·26	25·49	25·72
156	25·95	26·17	26·40	26·63	26·86	27·08	27·31	27·54	27·77	28·00
157	28·22	28·45	28·68	28·91	29·13	29·36	29·59	29·82	30·05	30·27
158	30·50	30·73	30·96	31·19	31·41	31·64	31·87	32·10	32·33	32·55
159	32·78	33·01	33·24	33·46	33·69	33·92	34·15	34·38	34·60	34·83
160	35·06	35·29	35·51	35·71	35·97	36·20	36·43	36·65	36·88	37·11
161	37·34	37·57	37·79	38·02	38·25	38·48	38·70	38·93	39·16	39·39
162	39·62	39·84	40·07	40·30	40·53	40·76	40·98	41·21	41·44	41·67
163	41·89	42·12	42·35	42·58	42·81	43·03	43·26	43·49	43·72	43·95
164	44·17	44·40	44·63	44·86	45·08	45·31	45·54	45·77	46·00	46·22
165	46·45	46·68	46·91	47·14	47·36	47·59	47·82	48·05	48·27	48·50
166	48·73	48·96	49·19	49·41	49·64	49·87	50·10	50·33	50·55	50·78
167	51·01	51·24	51·46	51·69	51·92	52·15	52·38	52·60	52·83	53·06
168	53·29	53·52	53·74	53·97	54·20	54·43	54·65	54·88	55·11	55·34
169	55·57	55·79	56·02	56·25	56·48	56·71	56·93	57·16	57·39	57·62
170	57·84	58·07	58·30	58·53	58·76	58·98	59·21	59·44	59·67	59·89
171	60·12	60·35	60·58	60·81	61·03	61·26	61·19	61·72	61·95	62·17
172	62·40	62·63	62·86	63·08	63·31	63·54	63·77	64·00	64·22	64·45
173	64·68	64·91	65·14	65·36	65·59	65·82	66·05	66·27	66·50	66·73
174	66·96	67·19	67·11	67·64	67·87	68·10	68·33	68·55	68·78	69·01

TABLE LXXVE (1).—*continued.*

V = c.cms. of $\frac{N}{10}$ acid corresponding to 1 grm.	Tenths of a cm. Cube. ·0	·1	·2	·3	·4	·5	·6	·7	·8	·9
175	69·24	69·46	69·69	69·92	70·15	70·38	70·60	70·83	71·06	71·29
176	71·52	71·74	71·97	72·20	72·43	72·65	72·88	73·11	73·34	73·57
177	73·79	74·02	74·25	74·48	74·71	74·93	75·16	75·39	75·62	75·84
178	76·07	76·30	76·53	76·76	76·98	77·21	77·44	77·67	77·90	78·12
179	78·35	78·58	78·81	79·03	79·26	79·49	79·72	79·95	80·17	80·40
180	80·63	80·86	81·09	81·31	81·54	81·77	82·00	82·22	82·45	82·68
181	82·91	83·14	83·36	83·59	83·82	84·05	84·28	84·50	84·73	84·96
182	85·19	85·41	85·64	85·87	86·10	86·33	86·55	86·78	87·01	87·24
183	87·46	87·69	87·92	88·15	88·38	88·60	88·83	89·06	89·29	89·52
184	89·74	89·97	90·20	90·43	90·65	90·88	91·11	91·34	91·57	91·79
185	92·02	92·25	92·48	92·71	92·93	93·16	93·39	93·62	93·84	94·07
186	94·30	94·53	94·76	94·98	95·21	95·44	95·67	95·90	96·12	96·35
187	96·58	96·81	97·03	97·26	97·49	97·72	97·95	98·17	98·40	98·63
188	98·86	99·09	99·31	99·54	99·77	100·00	*	*	*	*

TABLE LXXVE (2).—Percentage of $MgCO_3$ in a mixture of $MgCO_3$ and $CaCO_3$.

1 grm. $CaCO_3 \equiv 199·80020$ c.cms. $\frac{N}{10}$ acid; 1 grm. $MgCO_3 = 237·07918$ c.cms. $\frac{N}{10}$ acid.

If V = volume in c.cms. of $\frac{N}{10}$ acid, neutralised by 1 grm. of the mixture, then:—

$$\text{Percentage of } MgCO_3 \text{ in mixture} = (V - 199·80020) \times 2·6824765.$$

A difference of 0·01 c.cm. in V makes a difference of 0·0268 in the percentage of $MgCO_3$; so at best we cannot rely on anything beyond the second decimal.

V = c.cms. of $\frac{N}{10}$ acid corresponding to 1 grm.	Tenths of a cm. Cube. ·0	·1	·2	·3	·4	·5	·6	·7	·8	·9
199	*	*	*	*	*	*	*	*	*	0·27
200	0·54	0·80	1·07	1·34	1·61	1·88	2·15	2·41	2·68	2·95
201	3·28	3·49	3·75	4·02	4·29	4·56	4·83	5·10	5·36	5·63
202	5·90	6·17	6·44	6·71	6·97	7·24	7·51	7·78	8·05	8·32
203	8·58	8·85	9·12	9·39	9·66	9·92	10·19	10·46	10·73	11·00
204	11·27	11·53	11·80	12·07	12·34	12·61	12·88	13·14	13·41	13·68
205	13·95	14·22	14·48	14·75	15·02	15·29	15·56	15·83	16·09	16·36
206	16·63	16·90	17·17	17·44	17·70	17·97	18·24	18·51	18·78	19·05

TABLE LXXVE (2).—*continued.*

V = c.cms. of $\frac{N}{10}$ acid corresponding to 1 grm.	Tenths of a cm. Cube. ·0	·1	·2	·3	·4	·5	·6	·7	·8	·9
207	19·31	19·58	19·85	20·12	20·39	20·65	20·92	21·19	21·46	21·73
208	22·00	22·26	22·53	22·80	23·07	23·34	23·61	23·87	24·14	24·41
209	24·68	24·95	25·21	25·48	25·75	26·02	26·29	26·56	26·82	27·09
210	27·36	27·63	27·90	28·17	28·43	28·70	28·97	29·24	29·51	29·77
211	30·04	30·31	30·58	30·85	31·12	31·38	31·65	31·92	32·19	32·46
212	32·73	32·99	33·26	33·53	33·80	34·07	34·33	34·60	34·87	35·14
213	35·41	35·68	35·94	36·21	36·48	36·75	37·02	37·29	37·55	37·82
214	38·09	38·36	38·63	38·90	39·16	39·43	39·70	39·97	40·24	40·50
215	40·77	41·04	41·31	41·58	41·85	42·11	42·38	42·65	42·92	43·19
216	43·46	43·72	43·99	44·26	44·53	44·80	45·07	45·33	45·60	45·87
217	46·14	46·41	46·67	46·94	47·21	47·48	47·75	48·02	48·28	48·55
218	48·82	49·09	49·36	49·63	49·89	50·16	50·43	50·70	50·97	51·23
219	51·50	51·77	52·04	52·31	52·58	52·84	53·11	53·38	53·65	53·92
220	54·19	54·45	54·72	54·99	55·26	55·53	55·79	56·06	56·33	56·60
221	56·87	57·14	57·40	57·67	57·94	58·21	58·48	58·75	59·01	59·28
222	59·55	59·82	60·09	60·36	60·62	60·89	61·16	61·43	61·70	61·96
223	62·23	62·50	62·77	63·04	63·31	63·57	63·84	64·11	64·38	64·65
224	64·92	65·18	65·45	65·72	65·99	66·26	66·52	66·79	67·06	67·33
225	67·60	67·87	68·13	68·40	68·67	68·94	69·21	69·48	69·74	70·01
226	70·28	70·55	70·82	71·09	71·35	71·62	71·89	72·16	72·43	72·69
227	72·96	73·23	73·50	73·77	74·04	74·30	74·57	74·84	75·11	75·38
228	75·65	75·91	76·18	76·45	76·72	76·99	77·25	77·52	77·79	78·06
229	78·33	78·60	78·86	79·13	79·40	79·67	79·94	80·21	80·47	80·74
230	81·01	81·28	81·55	81·81	82·08	82·35	82·62	82·89	83·16	83·42
231	83·69	83·96	84·23	84·50	84·77	85·03	85·30	85·57	85·84	86·11
232	86·38	86·64	86·91	87·18	87·45	87·72	87·98	88·25	88·52	88·79
233	89·06	89·33	89·59	89·86	90·13	90·40	90·67	90·94	91·20	91·47
234	91·74	92·01	92·28	92·54	92·81	93·08	93·35	93·62	93·89	94·15
235	94·42	94·69	94·96	95·23	95·50	95·76	96·03	96·30	96·57	96·84
236	97·11	97·37	97·64	97·91	98·18	98·45	98·71	98·98	99·25	99·52
237	99·79	*	*	*	*	*	*	*	*	*

TABLE LXXVE (3).—Percentage of $CaCO_3$ in a mixture of $CaCO_3$ and $SrCO_3$.

1 grm. $SrCO_3$≡135·50135 c.cms. $\frac{N}{10}$ acid; 1 grm. $CaCO_3$≡199·80020 c.cms. $\frac{N}{10}$ acid.

If V = volume of $\frac{N}{10}$ acid, neutralised by 1 grm. of mixture, then:—

Percentage of $CaCO_3 = (V - 135{\cdot}50135) \times 1{\cdot}555238$.

A difference of 0·01 c.cm. in V makes a difference of 0·0156 in the percentage of $CaCO_3$: results to be relied on at best only to the second decimal.

V = c.cms. of $\frac{N}{10}$ acid corresponding to 1 grm.	Tenths of a cm. Cube.									
	·0	·1	·2	·3	·4	·5	·6	·7	·8	·9
135	*	*	*	*	*	*	0·15	0·31	0·46	0·62
136	0·78	0·93	1·09	1·24	1·40	1·55	1·71	1·86	2·02	2·18
137	2·33	2·49	2·64	2·80	2·95	3·11	3·26	3·42	3·57	3·73
138	3·89	4·04	4·20	4·35	4·51	4·66	4·82	4·97	5·13	5·29
139	5·44	5·60	5·75	5·91	6·06	6·22	6·37	6·53	6·69	6·84
140	7·00	7·15	7·31	7·46	7·62	7·77	7·93	8·09	8·24	8·40
141	8·55	8·71	8·86	9·02	9·17	9·33	9·48	9·64	9·80	9·95
142	10·11	10·26	10·42	10·57	10·73	10·88	11·04	11·20	11·35	11·51
143	11·66	11·82	11·97	12·13	12·28	12·44	12·59	12·75	12·91	13·06
144	13·22	13·37	13·53	13·68	13·84	14·00	14·15	14·31	14·46	14·62
145	14·77	14·93	15·08	15·24	15·39	15·55	15·71	15·86	16·02	16·17
146	16·33	16·48	16·64	16·79	16·95	17·11	17·26	17·42	17·57	17·73
147	17·88	18·04	18·19	18·35	18·51	18·66	18·82	18·97	19·13	19·28
148	19·44	19·59	19·75	19·90	20·06	20·22	20·37	20·53	20·68	20·84
149	20·99	21·15	21·30	21·46	21·62	21·77	21·93	22·08	22·24	22·39
150	22·55	22·70	22·86	23·02	23·17	23·33	23·48	23·64	23·79	23·95
151	24·10	24·26	24·42	24·57	24·73	24·88	25·04	25·19	25·35	25·50
152	25·66	25·81	25·97	26·13	26·28	26·44	26·59	26·75	26·90	27·06
153	27·21	27·37	27·53	27·68	27·84	27·99	28·15	28·30	28·46	28·61
154	28·77	28·93	29·08	29·24	29·39	29·55	29·70	29·86	30·01	30·17
155	30·33	30·48	30·64	30·79	30·95	31·10	31·26	31·41	31·57	31·72
156	31·88	32·04	32·19	32·35	32·50	32·66	32·81	32·97	33·12	33·28
157	33·44	33·59	33·75	33·90	34·06	34·21	34·37	34·52	34·68	34·84
158	34·99	35·15	35·30	35·46	35·61	35·77	35·92	36·08	36·23	36·39
159	36·55	36·70	36·86	37·01	37·17	37·32	37·48	37·63	37·79	37·95
160	38·10	38·26	38·41	38·57	38·72	38·88	39·03	39·19	39·35	39·50
161	39·65	39·81	39·97	40·12	40·28	40·43	40·59	40·75	40·90	41·06
162	41·21	41·37	41·52	41·68	41·83	41·99	42·14	42·30	42·46	42·61
163	42·77	42·92	43·08	43·23	43·39	43·54	43·70	43·86	44·01	44·17
164	44·32	44·48	44·63	44·79	44·94	45·10	45·26	45·41	45·57	45·72
165	45·88	46·03	46·19	46·34	46·50	46·66	46·81	46·97	47·12	47·27
166	47·43	47·59	47·74	47·90	48·05	48·21	48·37	48·52	48·68	48·83

TABLE LXXVE (3).—*continued.*

V = c.cms. of $\frac{N}{10}$ acid corresponding to 1 grm.	Tenths of a cm. Cube.									
	·0	·1	·2	·3	·4	·5	·6	·7	·8	·9
167	48·99	49·14	49·30	49·45	49·61	49·77	49·92	50·08	50·23	50·39
168	50·54	50·70	50·85	51·01	51·17	51·32	51·48	51·63	51·79	51·94
169	52·10	52·25	52·41	52·56	52·72	52·88	53·03	53·19	53·34	53·50
170	53·65	53·81	53·96	54·12	54·28	54·43	54·59	54·74	54·90	55·05
171	55·21	55·36	55·52	55·68	55·83	55·99	56·14	56·30	56·45	56·61
172	56·76	56·92	57·08	57·23	57·39	57·54	57·70	57·85	58·01	58·16
173	58·32	58·47	58·63	58·79	58·94	59·10	59·25	59·41	59·56	59·72
174	59·87	60·03	60·19	60·34	60·50	60·65	60·81	60·96	61·12	61·27
175	61·43	61·59	61·74	61·90	62·05	62·21	62·36	62·52	62·67	62·83
176	62·99	63·14	63·30	63·45	63·61	63·76	63·92	64·07	64·23	64·38
177	64·54	64·70	64·85	65·01	65·16	65·32	65·47	65·63	65·78	65·94
178	66·10	66·25	66·41	66·56	66·72	66·87	67·03	67·18	67·34	67·50
179	67·65	67·81	67·96	68·12	68·27	68·43	68·58	68·74	68·89	69·05
180	69·21	69·36	69·52	69·67	69·83	69·98	70·14	70·29	70·45	70·61
181	70·76	70·92	71·07	71·23	71·38	71·54	71·69	71·85	72·01	72·16
182	72·32	72·47	72·63	72·78	72·94	73·09	73·25	73·41	73·56	73·72
183	73·87	74·03	74·18	74·34	74·49	74·65	74·80	74·96	75·12	75·27
184	75·43	75·58	75·74	75·89	76·05	76·20	76·36	76·52	76·67	76·83
185	76·98	77·14	77·29	77·45	77·60	77·76	77·92	78·07	78·23	78·38
186	78·54	78·69	78·85	79·00	79·16	79·32	79·47	79·63	79·78	79·94
187	80·09	80·25	80·40	80·56	80·71	80·87	81·03	81·18	81·34	81·49
188	81·65	81·80	81·96	82·11	82·27	82·43	82·58	82·74	82·89	83·05
189	83·20	83·36	83·51	83·67	83·83	83·98	84·14	84·29	84·45	84·60
190	84·76	84·91	85·07	85·22	85·38	85·54	85·69	85·85	86·00	86·16
191	86·31	86·47	86·62	86·78	86·94	87·09	87·25	87·40	87·56	87·71
192	87·87	88·02	88·18	88·34	88·49	88·65	88·80	88·96	89·11	89·27
193	89·42	89·58	89·74	89·89	90·05	90·20	90·36	90·51	90·67	90·82
194	90·98	91·13	91·29	91·45	91·60	91·76	91·91	92·07	92·22	92·38
195	92·53	92·69	92·85	93·00	93·16	93·31	93·47	93·62	93·78	93·93
196	94·09	94·25	94·40	94·56	94·71	94·87	95·02	95·18	95·33	95·49
197	95·65	95·80	95·96	96·11	96·27	96·42	96·58	96·73	96·89	97·04
198	97·20	97·36	97·51	97·67	97·82	97·98	98·13	98·29	98·44	98·60
199	98·76	98·91	99·07	99·22	99·38	99·53	99·69	99·84	100·00	*

TABLE LXXVE (4).—Percentage of $CaCO_3$ in a mixture of $CaCO_3$ and $BaCO_3$.

1 grm. $BaCO_3 \equiv 101{\cdot}31712$ c.cms. $\frac{N}{10}$ acid; 1 grm. $CaCO_3 = 199{\cdot}80020$ c.cms. $\frac{N}{10}$ acid.

If V = volume in c.cms. of $\frac{N}{10}$ acid, neutralised by 1 grm. of mixture, then:—

$$\text{Percentage of } CaCO_3 = (V - 101{\cdot}31712) \times 1{\cdot}0154028.$$

Here more reliance may, with very finely graduated burettes, be placed on the second decimal in the percentages, but nothing further can be relied upon.

V = c.cms. of $\frac{N}{10}$ acid corresponding to 1 grm.	Tenths of a cm. Cube.									
	·0	·1	·2	·3	·4	·5	·6	·7	·8	·9
101	*	*	*	*	0·08	0·19	0·29	0·39	0·49	0·59
102	0·69	0·79	0·90	1·00	1·10	1·20	1·30	1·40	1·51	1·61
103	1·71	1·81	1·91	2·01	2·11	2·22	2·32	2·42	2·52	2·62
104	2·72	2·83	2·93	3·03	3·13	3·23	3·33	3·43	3·54	3·64
105	3·74	3·84	3·94	4·04	4·15	4·25	4·35	4·45	4·55	4·65
106	4·76	4·86	4·96	5·06	5·16	5·26	5·36	5·47	5·57	5·67
107	5·77	5·87	5·97	6·08	6·18	6·28	6·38	6·48	6·58	6·68
108	6·79	6·89	6·99	7·09	7·19	7·29	7·40	7·50	7·60	7·70
109	7·80	7·90	8·00	8·11	8·21	8·31	8·41	8·51	8·61	8·72
110	8·82	8·92	9·02	9·12	9·22	9·32	9·43	9·53	9·63	9·73
111	9·83	9·93	10·04	10·14	10·24	10·34	10·44	10·54	10·64	10·75
112	10·85	10·95	11·05	11·15	11·25	11·36	11·46	11·56	11·66	11·76
113	11·86	11·96	12·07	12·17	12·27	12·37	12·47	12·57	12·68	12·78
114	12·88	12·98	13·08	13·18	13·28	13·39	13·49	13·59	13·69	13·79
115	13·89	14·00	14·10	14·20	14·30	14·40	14·50	14·60	14·71	14·81
116	14·91	15·01	15·11	15·21	15·32	15·42	15·52	15·62	15·72	15·82
117	15·92	16·03	16·13	16·23	16·33	16·43	16·53	16·64	16·74	16·84
118	16·94	17·04	17·14	17·24	17·35	17·45	17·55	17·65	17·75	17·8
119	17·96	18·06	18·16	18·26	18·36	18·46	18·56	18·67	18·77	18·87
120	18·97	19·07	19·17	19·28	19·38	19·48	19·58	19·68	19·78	19·8
121	19·99	20·09	20·19	20·29	20·39	20·49	20·60	20·70	20·80	20·9
122	21·00	21·10	21·20	21·31	21·41	21·51	21·61	21·71	21·81	21·9
123	22·02	22·12	22·22	22·32	22·42	22·52	22·63	22·73	22·83	22·9
124	23·03	23·13	23·24	23·34	23·44	23·54	23·64	23·74	23·84	23·9
125	24·05	24·15	24·25	24·35	24·45	24·56	24·66	24·76	24·86	24·9
126	25·06	25·16	25·27	25·37	25·47	25·57	25·67	25·77	25·88	25·9
127	26·08	26·18	26·28	26·38	26·48	26·59	26·69	26·79	26·89	26·9
128	27·09	27·20	27·30	27·40	27·50	27·60	27·70	27·80	27·91	28·0
129	28·11	28·21	28·31	28·41	28·52	28·62	28·72	28·82	28·92	29·0
130	29·12	29·23	29·33	29·43	29·53	29·63	29·73	29·84	29·94	30·0
131	30·14	30·24	30·34	30·44	30·55	30·65	30·75	30·85	30·95	31·0
132	31·15	31·26	31·36	31·46	31·56	31·66	31·76	31·87	31·97	32·0

TABLE LXXVE (4).—*continued.*

V = c.cms. of $\frac{N}{10}$ acid corresponding to 1 grm.	Tenths of a cm. Cube.									
	·0	·1	·2	·3	·4	·5	·6	·7	·8	·9
133	32·17	32·27	32·37	32·48	32·58	32·68	32·78	32·88	32·98	33·08
134	33·19	33·29	33·39	33·49	33·59	33·69	33·80	33·90	34·00	34·10
135	34·20	34·30	34·40	34·51	34·61	34·71	34·81	34·91	35·01	35·12
136	35·22	35·32	35·42	35·52	35·62	35·72	35·83	35·93	36·03	36·13
137	36·23	36·33	36·44	36·54	36·64	36·74	36·84	36·94	37·04	37·15
138	37·25	37·35	37·45	37·55	37·65	37·76	37·86	37·96	38·06	38·16
139	38·26	38·36	38·47	38·57	38·67	38·77	38·87	38·97	39·08	39·18
140	39·28	39·38	39·48	39·58	39·68	39·79	39·89	39·99	40·09	40·19
141	40·29	40·40	40·50	40·60	40·70	40·80	40·90	41·00	41·11	41·21
142	41·31	41·41	41·51	41·61	41·72	41·82	41·92	42·02	42·12	42·22
143	42·32	42·43	42·53	42·63	42·73	42·83	42·93	43·04	43·14	43·24
144	43·34	43·44	43·54	43·64	43·75	43·85	43·95	44·05	44·15	44·25
145	44·36	44·46	44·56	44·66	44·76	44·86	44·96	45·07	45·17	45·27
146	45·37	45·47	45·57	45·68	45·78	45·88	45·98	46·08	46·18	46·28
147	46·39	46·49	46·59	46·69	46·79	46·89	47·00	47·10	47·20	47·30
148	47·40	47·50	47·61	47·71	47·81	47·91	48·01	48·11	48·21	48·32
149	48·42	48·52	48·62	48·72	48·82	48·93	49·03	49·13	49·23	49·33
150	49·43	49·53	49·64	49·74	49·84	49·94	50·04	50·14	50·25	50·35
151	50·45	50·55	50·65	50·75	50·85	50·96	51·06	51·16	51·26	51·36
152	51·46	51·57	51·67	51·77	51·87	51·97	52·07	52·17	52·28	52·38
153	52·48	52·58	52·68	52·78	52·89	52·99	53·09	53·19	53·29	53·39
154	53·49	53·60	53·70	53·80	53·90	54·00	54·10	54·21	54·31	54·41
155	54·51	54·61	54·71	54·81	54·92	55·02	55·12	55·22	55·32	55·42
156	55·53	55·63	55·73	55·83	55·93	56·03	56·13	56·24	56·34	56·44
157	56·54	56·64	56·74	56·85	56·95	57·05	57·15	57·25	57·35	57·45
158	57·56	57·66	57·76	57·86	57·96	58·06	58·17	58·27	58·37	58·47
159	58·57	58·67	58·77	58·88	58·98	59·08	59·18	59·28	59·38	59·49
160	59·59	59·69	59·79	59·89	59·99	60·09	60·20	60·30	60·40	60·50
161	60·60	60·70	60·81	60·91	61·01	61·11	61·21	61·31	61·41	61·52
162	61·62	61·72	61·82	61·92	62·02	62·13	62·23	62·33	62·43	62·53
163	62·63	62·73	62·84	62·94	63·04	63·14	63·24	63·34	63·45	63·55
164	63·65	63·75	63·85	63·95	64·05	64·16	64·26	64·36	64·46	64·56
165	64·66	64·77	64·87	64·97	65·07	65·17	65·27	65·37	65·48	65·58
166	65·68	65·78	65·88	65·98	66·09	66·19	66·29	66·39	66·49	66·59
167	66·69	66·80	66·90	67·00	67·10	67·20	67·30	67·41	67·51	67·61
168	67·71	67·81	67·91	68·01	68·12	68·22	68·32	68·12	68·52	68·62
169	68·73	68·83	68·93	69·03	69·13	69·23	69·33	69·44	69·54	69·64

TABLE LXXVe (4).—*continued.*

V = c.cms. of $\frac{N}{10}$ acid corresponding to 1 grm.	Tenths of a cm. Cube. ·0	·1	·2	·3	·4	·5	·6	·7	·8	·9
170	69·74	69·84	69·94	70·05	70·15	70·25	70·35	70·45	70·55	70·65
171	70·76	70·86	70·96	71·06	71·16	71·26	71·37	71·47	71·57	71·67
172	71·77	71·87	71·97	72·08	72·18	72·28	72·38	72·48	72·58	72·69
173	72·79	72·89	72·99	73·09	73·19	73·29	73·40	73·50	73·60	73·70
174	73·80	73·90	74·01	74·11	74·21	74·31	74·41	74·51	74·61	74·72
175	74·82	74·92	75·02	75·12	75·22	75·33	75·43	75·53	75·63	75·73
176	75·83	75·93	76·04	76·14	76·24	76·34	76·44	76·54	76·65	76·75
177	76·85	76·95	77·05	77·15	77·25	77·36	77·46	77·56	77·66	77·76
178	77·86	77·97	78·07	78·17	78·27	78·37	78·47	78·57	78·68	78·78
179	78·88	78·98	79·08	79·18	79·29	79·39	79·49	79·59	79·69	79·79
180	79·89	80·00	80·10	80·20	80·30	80·40	80·50	80·61	80·71	80·81
181	80·91	81·01	81·11	81·21	81·32	81·42	81·52	81·62	81·72	81·82
182	81·93	82·03	82·13	82·23	82·33	82·43	82·53	82·64	82·74	82·84
183	82·94	83·04	83·14	83·25	83·35	83·45	83·55	83·65	83·75	83·85
184	83·96	84·06	84·16	84·26	84·36	84·46	84·57	84·67	84·77	84·87
185	84·97	85·07	85·17	85·28	85·38	85·48	85·58	85·68	85·78	85·89
186	85·99	86·09	86·19	86·29	86·39	86·49	86·60	86·70	86·80	86·90
187	87·00	87·10	87·21	87·31	87·41	87·51	87·61	87·71	87·81	87·92
188	88·02	88·12	88·22	88·32	88·42	88·53	88·63	88·73	88·83	88·93
189	89·03	89·13	89·24	89·34	89·44	89·54	89·64	89·74	89·85	89·95
190	90·05	90·15	90·25	90·35	90·46	90·56	90·66	90·76	90·86	90·96
191	91·06	91·17	91·27	91·37	91·47	91·57	91·67	91·78	91·88	91·98
192	92·08	92·18	92·28	92·38	92·49	92·59	92·69	92·79	92·89	92·99
193	93·10	93·20	93·30	93·40	93·50	93·60	93·70	93·81	93·91	94·01
194	94·11	94·21	94·31	94·42	94·52	94·62	94·72	94·82	94·92	95·02
195	95·13	95·23	95·33	95·43	95·53	95·63	95·74	95·84	95·94	96·04
196	96·14	96·24	96·34	96·45	96·55	96·65	96·75	96·85	96·95	97·06
197	97·16	97·26	97·36	97·46	97·56	97·66	97·77	97·87	97·97	98·07
198	98·17	98·27	98·38	98·48	98·58	98·68	98·78	98·88	98·98	99·09
199	99·19	99·29	99·39	99·49	99·59	99·70	99·80	99·90	100·00	*

The following mixtures are less likely to occur:—

$MgCO_3$ and $SrCO_3$; percentage of $MgCO_3 = (V - 135·50135) \times 0·9844668$.

$MgCO_3$ and $BaCO_3$; percentage of $MgCO_3 = (V - 101·317123) \times 0·7365828$.

$SrCO_3$ and $BaCO_3$; percentage of $SrCO_3 = (V - 101·317123) \times 2·9253253$.

TABLE LXXVE (5).—Percentage of NaCl in a mixture of NaCl and KCl.

1 grm. KCl≡134·048257 c.cms. of $\frac{N}{10}$ silver sol.; 1 grm. NaCl≡170·940170 c.cms $\frac{N}{10}$ silver sol.

If V = volume in c.cms. of $\frac{N}{10}$ silver solution corresponding to 1 grm. of mixture, then :—

$$\text{Percentage of NaCl} = (V - 134{\cdot}048257) \times 2{\cdot}7106211.$$

As one can work with a centinormal silver solution, and so get finer readings, the percentages are given to three places of decimals, but more than two can scarcely be relied upon.

V = c.cms. of $\frac{N}{10}$ Silver Solution corresponding to 1 grm.	Tenths of a cm. Cube.									
	·0	·1	·2	·3	·4	·5	·6	·7	·8	·9
134	*	0·140	0·411	0·682	0·953	1·225	1·496	1·767	2·038	2·309
135	2·580	2·851	3·122	3·393	3·664	3·935	4·206	4·477	4·748	5·019
136	5·290	5·561	5·833	6·104	6·375	6·646	6·917	7·188	7·459	7·730
137	8·001	8·272	8·543	8·814	9·085	9·356	9·627	9·898	10·170	10·441
138	10·712	10·983	11·254	11·525	11·796	12·067	12·338	12·609	12·880	13·151
139	13·422	13·693	13·964	14·235	14·507	14·778	15·049	15·320	15·591	15·862
140	16·133	16·404	16·675	16·946	17·217	17·488	17·759	18·030	18·301	18·572
141	18·844	19·115	19·386	19·657	19·928	20·199	20·470	20·741	21·012	21·283
142	21·554	21·825	22·096	22·367	22·638	22·909	23·181	23·452	23·723	23·994
143	24·265	24·536	24·807	25·078	25·349	25·620	25·891	26·162	26·433	26·704
144	26·975	27·246	27·518	27·789	28·060	28·331	28·602	28·873	29·144	29·415
145	29·686	29·957	30·228	30·499	30·770	31·041	31·312	31·583	31·855	32·126
146	32·397	32·668	32·939	33·210	33·481	33·752	34·023	34·294	34·565	34·836
147	35·107	35·378	35·649	35·920	36·192	36·463	36·733	37·005	37·276	37·547
148	37·818	38·089	38·360	38·631	38·902	39·173	39·444	39·715	39·986	40·257
149	40·529	40·800	41·071	41·342	41·613	41·884	42·155	42·426	42·697	42·968
150	43·239	43·510	43·781	44·052	44·323	44·594	44·866	45·137	45·408	45·679
151	45·950	46·221	46·492	46·763	47·034	47·305	47·576	47·847	48·118	48·389
152	48·660	48·931	49·202	49·474	49·745	50·016	50·287	50·558	50·829	51·100
153	51·371	51·642	51·913	52·184	52·455	52·726	52·997	53·268	53·539	53·811
154	54·082	54·353	54·624	54·895	55·166	55·437	55·708	55·979	56·250	56·521
155	56·792	57·063	57·334	57·605	57·876	58·148	58·419	58·690	58·961	59·232
156	59·503	59·774	60·045	60·316	60·587	60·858	61·129	61·400	61·671	61·942
157	62·213	62·485	62·756	63·027	63·298	63·569	63·840	64·111	64·382	64·653
158	64·924	65·195	65·466	65·737	66·008	66·279	66·550	66·822	67·093	67·364
159	67·635	67·906	68·177	68·448	68·719	68·990	69·261	69·532	69·803	70·074
160	70·345	70·616	70·887	71·159	71·430	71·701	71·972	72·243	72·514	72·785
161	73·056	73·327	73·598	73·869	74·140	74·411	74·682	74·953	75·224	75·496
162	75·767	76·038	76·309	76·580	76·851	77·122	77·393	77·664	77·935	78·206
163	78·477	78·748	79·019	79·290	79·561	79·832	80·104	80·375	80·646	80·917
164	81·188	81·459	81·730	82·001	82·272	82·543	82·814	83·085	83·356	83·627
165	83·898	84·170	84·441	84·712	84·983	85·254	85·525	85·796	86·067	86·338
166	86·609	86·880	87·151	87·422	87·693	87·964	88·235	88·507	88·778	89·049
167	89·320	89·591	89·862	90·133	90·404	90·675	90·946	91·217	91·488	91·759
168	92·030	92·301	92·572	92·843	93·115	93·386	93·657	93·928	94·199	94·469
169	94·741	95·012	95·283	95·554	95·825	96·096	96·367	96·638	96·909	97·180
170	97·452	97·723	97·994	98·265	98·536	98·807	99·078	99·349	99·620	99·891

TABLE LXXVE (6).—Percentage of AgBr in a mixture of AgBr and AgCl, calculated from loss of weight per 1 grm. of mixture when the AgBr has been converted into AgCl.

Loss of Weight, Centigrammes.	Milligrammes.									
	0	1	2	3	4	5	6	7	8	9
0	*	0·4221	0·8443	1·2664	1·6885	2·1106	2·5328	2·9549	3·3770	3·7992
1	4·2213	4·6434	5·0656	5·4877	5·9098	6·3319	6·7541	7·1762	7·5983	8·0205
2	8·4426	8·8647	9·2869	9·7090	10·1311	10·5532	10·9754	11·3975	11·8196	12·2418
3	12·6639	13·0860	13·5082	13·9303	14·3524	14·7745	15·1967	15·6188	16·0409	16·4631
4	16·8852	17·3073	17·7295	18·1516	18·5737	18·9958	19·4180	19·8401	20·2622	20·6844
5	21·1065	21·5286	21·9508	22·3729	22·7950	23·2171	23·6393	24·0614	24·4835	24·9057
6	25·3278	25 7499	26·1721	26·5942	27·0163	27·4384	27·8606	28·2827	28·7048	29·1270
7	29·5491	29·9712	30·3933	30·8155	31·2376	31·6597	32·0819	32·5040	32·9261	33·3483
8	33·7704	34·1925	34·6146	35·0368	35·4589	35·8810	36·3032	36·7253	37·1474	37·5696
9	37·9917	38·4138	38·8359	39·2581	39·6802	40·1023	40·5245	40·9466	41·3687	41·7909
10	42·2130	42·6351	43·0572	43·4794	43·9015	44·3236	44·7458	45·1679	45·5900	46·0122
11	46·4343	46·8564	47·2785	47·7007	48·1228	48·5449	48·9671	49·3892	49·8113	50·2335
12	50·6556	51·0777	51·4998	51·9220	52·3441	52·7662	53·1884	53·6105	54·0326	54·4548
13	54·8769	55·2990	55·7211	56·1433	56·5654	56·9875	57·4097	57·8318	58·2539	58·6761
14	59·0982	59·5203	59·9424	60·3646	60·7867	61·2088	61·6310	62·0531	62·4752	62·8973
15	63·3195	63·7416	64·1637	64·5859	65·0080	65·4301	65·8523	66·2744	66·6965	67·1186
16	67·5408	67·9629	68·3850	68·8072	69·2293	69·6514	70·0736	70·4957	70·9178	71·3399
17	71·7621	72·1842	72·6063	73·0285	73·4506	73·8727	74·2949	74·7170	75·1391	75·5612
18	75·9834	76·4055	76·8276	77·2498	77·6719	78·0940	78·5162	78·9383	79·3604	79·7825
19	80·2047	80·6268	81·0489	81·4711	81·8932	82·3153	82·7375	83·1596	83·5817	84·0038
20	84·4260	84·8481	85·2702	85·6924	86·1145	86·5366	86·9588	87·3809	87·8030	88·2251
21	88·6473	89 0694	89·4915	89·9137	90·3358	90·7579	91·1800	91·6022	92·0243	92·4464
22	92·8686	93·2907	93·7128	94·1350	94·5571	94·9792	95·4013	95·8235	96·2456	96·6677
23	97·0899	97·5120	97·9341	98·3563	98·7784	99·2005	99·6226	*	*	*

Change in the percentage of AgBr for every tenth of a milligramme change in weight of 1 grm. of mixture.

Weight. mgm.	Percentages.
0·1	0·042213
0·2	084426
0·3	126639
0·4	168852
0·5	211065
0·6	253278
0·7	295491
0·8	337704
0·9	379917
1·0	422130

TABLE LXXVE (7).—Percentage of AgI in a mixture of AgI and AgBr, calculated from loss of weight per gramme of mixture when the AgI has been converted into AgBr.

Loss of Weight, Centigrammes.	Milligrammes.									
	0	1	2	3	4	5	6	7	8	9
0	*	0·4997	0·9994	1·4990	1·9987	2·4984	2·9981	3·4978	3·9974	4·4971
1	4·9968	5·4965	5·9962	6·4959	6·9955	7·4952	7·9949	8·4946	8·9943	9·4939
2	9·9936	10·4933	10·9930	11·4927	11·9923	12·4920	12·9917	13·4914	13·9911	14 4907
3	14·9904	15·4901	15·9898	16·4895	16·9892	17·4888	17·9885	18·4882	18·9879	19·4876
4	19·9872	20·4869	20·9866	21·4863	21·9860	22·4856	22·9853	23·4850	23·9847	24·4844
5	24·9840	25·4837	25·9834	26·4831	26·9828	27·4825	27·9821	28·4818	28·9815	29·4812
6	29·9809	30·4805	30·9802	31·4799	31·9796	32·4793	32·9789	33·4786	33·9783	34·4780
7	34·9777	35·4773	35·9770	36·4767	36·9764	37·4761	37·9757	38·4754	38·9751	39·4748
8	39·9745	40·4742	40·9738	41·4735	41·9732	42·4729	42·9726	43·4722	43·9719	44·4716
9	44·9713	45·4710	45·9706	46·4703	46·9700	47·4697	47·9694	48·4690	48·9687	49·4684
10	49·9681	50·4678	50·9675	51·4671	51·9668	52·4665	52·9662	53·4659	53·9655	54·4652
11	54·9649	55·4646	55·9643	56·4639	56·9636	57·4633	57·9630	58·4627	58·9623	59·4620
12	59·9617	60·4614	60·9611	61·4608	61·9604	62·4601	62·9598	63·4595	63 9592	64·4588
13	64·9585	65·4582	65·9579	66·4576	66·9572	67·4569	67·9566	68·4563	68 9560	69·4556
14	69·9553	70·4550	70·9547	71·4544	71·9541	72·4537	72·9534	73·4531	73·9528	74·4525
15	74·9521	75·4518	75 9515	76·4512	76·9509	77·4505	77·9502	78·4499	78·9496	79·4493
16	79·9489	80·4486	80·9483	81·4480	81·9477	82·4474	82·9470	83·4467	83·9464	84·4461
17	84·9458	85·4454	85·9451	86·4448	86·9445	87·4442	87·9438	88·4435	88·9432	89·4429
18	89·9426	90·4422	90·9419	91·4416	91·9413	92·4410	92·9407	93·4403	93·9400	94·4397
19	94·9394	95·4390	95·9387	96·4384	96·9381	97·4378	97·9375	98 4371	98·9368	99·4365
20	99·9362	*	*	*	*	*	*	*	*	*

Change in the percentage of AgI for every tenth of a milligramme change in weight of 1 grm. of mixture.

Weight mgm.	Percentages.
0·1	0·049968
0·2	099936
0·3	149904
0·4	199872
0·5	249840
0·6	299809
0·7	349777
0·8	399745
0·9	449713
1·0	499681

TABLE LXXVE (8).—Percentage of AgI in a mixture of AgI and AgCl, calculated from loss of weight per 1 gramme of mixture when the AgI has been converted into AgCl.

Loss of Weight, Centigrammes.	Milligrammes.									
	0	1	2	3	4	5	6	7	8	9
0		0·2568	0·5136	0·7703	1·0271	1·2839	1·5407	1·7974	2·0542	2·3110
1	2·5678	2·8246	3·0813	3·3381	3·5949	3·8517	4·1084	4·3652	4·6220	4·8788
2	5·1355	5·3923	5·6491	5·9059	6·1627	6·4194	6·6762	6·9330	7·1898	7·4465
3	7·7033	7·9601	8·2169	8·4737	8·7304	8·9872	9·2440	9·5008	9·7575	10·0143
4	10·2711	10·5279	10·7847	11·0414	11·2982	11·5550	11·8118	12·0686	12·3253	12·5821
5	12·8389	13·0956	13·3524	13·6092	13·8660	14·1228	14·3795	14·6363	14·8931	15·1499
6	15·4066	15·6634	15·9202	16·1770	16·4338	16·6905	16·9473	17·2041	17·4609	17·7176
7	17·9744	18·2312	18·4880	18·7448	19·0015	19·2583	19·5151	19·7719	20·0286	20·2854
8	20·5422	20·7990	21·0558	21·3125	21·5693	21·8261	22·0829	22·3396	22·5964	22·8532
9	23·1100	23·3667	23·6235	23·8803	24·1371	24·3939	24·6506	24·9074	25·1642	25·4210
10	25·6777	25·9345	26·1913	26·4481	26·7049	26·9616	27·2184	27·4752	27·7320	27·9887
11	28·2455	28·5023	28·7591	29·0159	29·2726	29·5294	29·7862	30·0430	30·2997	30·5565
12	30·8133	31·0701	31·3268	31·5836	31·8404	32·0972	32·3540	32·6107	32·8675	33·1243
13	33·3811	33·6378	33·8946	34·1514	34·4082	34·6650	34·9217	35·1785	35·4353	35·6921
14	35·9488	36·2056	36·4624	36·7192	36·9760	37·2327	37·4895	37·7463	38·0031	38·2598
15	38·5166	38·7734	39·0302	39·2869	39·5437	39·8005	40·0573	40·3141	40·5708	40·8276
16	41·0844	41·3412	41·5979	41·8547	42·1115	42·3683	42·6251	42·8818	43·1386	43·3954
17	43·6522	43·9089	44·1657	44·4225	44·6793	44·9361	45·1928	45·4496	45·7064	45·9632
18	46·2199	46·4767	46·7335	46·9903	47·2470	47·5038	47·7606	48·0174	48·2742	48·5309
19	48·7877	49·0445	49·3013	49·5580	49·8148	50·0716	50·3284	50·5852	50·8419	51·0987
20	51·3555	51·6123	51·8690	52·1258	52·3826	52·6394	52·8962	53·1529	53·4097	53·6665
21	53·9233	54·1800	54·4368	51·6936	54·9504	55·2071	55·4639	55·7207	55·9775	56·2343
22	56·4910	56·7478	57·0046	57·2614	57·5181	57·7749	58·0317	58·2885	58·5453	58·8020
23	59·0588	59·3156	59·5724	59·8291	60·0859	60·3427	60·5995	60·8563	61·1130	61·3698
24	61·6266	61·8834	62·1401	62·3969	62·6537	62·9105	63·1673	63·4240	63·6808	63·9376
25	64·1944	64·4511	64·7079	64·9647	65·2215	65·4782	65·7350	65·9918	66·2486	66·5054
26	66·7621	67·0189	67·2757	67·5325	67·7892	68·0460	68·3028	68·5596	68·8164	69·0731
27	69·3299	69·5867	69·8435	70·1002	70·3570	70·6138	70·8706	71·1274	71·3841	71·6409
28	71·8977	72·1545	72·4112	72·6680	72·9248	73·1816	73·4383	73·6951	73·9519	74·2087
29	74·4655	74·7222	71·9790	75·2358	75·4926	75·7493	76·0061	76·2629	76·5197	76·7765
30	77·0332	77·2900	77·5468	77·8036	78·0603	78·3171	78·5739	78·8307	79·0875	79·3442
31	79·6010	79·8578	80·1146	80·3713	80·6281	80·8849	81·1417	81·3984	81·6552	81·9120
32	82·1688	82·4256	82·6823	82·9391	83·1959	83·4527	83·7094	83·9662	84·2230	84·4798
33	84·7366	84·9933	85·2501	85·5069	85·7637	86·0204	86·2772	86·5340	86·7908	87·0476
34	87·3043	87·5611	87·8179	88 0747	88·3314	88·5882	88·8450	89·1018	89·3585	89·6153
35	89 8721	90·1289	90·3857	90·6424	90·8992	91·1560	91·4128	91·6695	91·9263	92·1831
36	92·4399	92·6967	92·9534	93·2102	93·4670	93·7238	93·9805	94·2373	94·4941	94·7509
37	95·0077	95·2644	95·5212	95·7780	96·0348	96·2915	96·5483	96·8051	97·0619	97·3186
38	97·5754	97·8322	98·0890	98·3458	98·6025	98·8593	99·1161	99·3729	99·6296	99·8864

Change in the percentage of AgI for every tenth of a milligramme change in weight of 1 grm. of mixture.

Change in mgm.	Change in percentage.	Change in mgm.	Change in percentage.
0·1	0·025678	0·6	0·154067
0·2	051356	0·7	179744
0·3	077033	0·8	205422
0·4	102711	0·9	231100
0·5	128389	1·0	256777

TABLE LXXVE (9).—Weights of various bromides, etc., corresponding to known loss of weight on replacing bromine by chlorine.

Loss of Weight on replacing Br by Cl.	Corresponding Weights of				
	Br.	HBr.	NaBr.	KBr.	AgBr.
1	1·796450	1·819097	2·314311	2·676028	4·221299
2	3·592900	3·638194	4·628623	5·352056	8·442597
3	5·389351	5·457291	6·942934	8·028084	12·663896
4	7·185801	7·276387	9·257246	10·704111	16·885194
5	8·982251	9·095484	11·571557	13·380139	21·106493
6	10·778701	10·914581	13·885868	16·056167	25·327792
7	12·575152	12·733678	16·200180	18·732195	29·549090
8	14·371602	14·552775	18·514491	21·408223	33·770389
9	16·168052	16·371871	20·828803	24·084251	37·991687
10	17·964502	18·190968	23·143114	26·760279	42·212986
11	19·760953	20·010065	25·457425	29·436306	46·434284
12	21·557403	21·829162	27·771737	32·112334	50·655583
13	23·353853	23·648259	30·086048	34·788362	54·876882
14	25·150303	25·467356	32·400359	37·464390	59·098180
15	26·946754	27·286452	34·714671	40·140418	63·319479
16	28·743204	29·105549	37·028982	42·816446	67·540777
17	30·539654	30·924646	39·343294	45·492474	71·762076
18	32·336104	32·743743	41·657605	48·168501	75·983375
19	34·132554	34·562840	43·971916	50·744529	80·204673
20	35·929005	36·381937	46·286228	53·520557	84·425972
21	37·725455	38·201033	48·600539	56·196585	88·647270
22	39·521905	40·020130	50·914851	58·872613	92·868569
23	41·318355	41·839227	53·229162	61·548641	97·089867
24	43·114806	43·658324	55·543473	64·224669	
25	44·911256	45·477421	57·857785	66·900696	
26	46·707706	47·296518	60·172096	69·576724	
27	48·504156	49·115614	62·486408	72·252752	
28	50·300607	50·934711	64·800719	74·928780	
29	52·097057	52·753808	67·115030	77·604808	
30	53·893507	54·572905	69·429342	80·280836	
31	55·689957	56·392002	71·743653	82·956864	
32	57·486408	58·211099	74·057965	85·632892	
33	59·282858	60·030195	76·372276	88·308919	
34	61·079308	61·849292	78·686587	90·984947	
35	62·875758	63·668389	81·000899	93·660975	

TABLE LXXVE (9)—*continued.*

Loss of Weight on replacing Br by Cl.	Corresponding Weights of Br.	HBr.	NaBr.	KBr.	AgBr.
36	64·672208	65·487486	83·315210	96·337003	
37	66·468659	67·306583	85·629521	99·013031	
38	68·265109	69·125680	87·943833		
39	70·061559	70·944776	90·258144		
40	71·858009	72·763873	92·572456		
41	73·654460	74·582970	94·886767		
42	75·450910	76·402067	97·201078		
43	77·247360	78·221164	99·515390		
44	79·043810	80·040261			
45	80·840261	81·849357			
46	82·636711	83·678454			
47	84·433161	85·497551			
48	86·229611	87·316648			
49	88·026062	89·135745			
50	89·822512	90·954842			
51	91·618962	92·773938			
52	93·415412	94·593035			
53	95·211863	96·412132			
54	97·008313	98·231229			
55	98·804763				

If a gramme of the substance was taken, and the numbers in the first column denote centigrammes, then the numbers in columns 2 to 6 give percentages.

Corresponding weights of bromine and various bromides, etc.

Br.	HBr.	NaBr.	KBr.	AgBr.	Cl to replace Br.	Loss on replacing Br_2 by Cl.	Loss on replacing Br by O.
1	1·012606	1·288269	1·489620	2·349800	0·443347	0·556653	0·912156
2	2·025213	2·576538	2·979240	4·699600	0·886693	1·113307	1·824912
3	3·037819	3·864807	4·468859	7·049400	1·330040	1·669960	2·737369
4	4·050425	5·153077	5·958479	9·399200	1·773387	2·226613	3·649825
5	5·063032	6·441346	7·448099	11·748999	2·216733	2·783267	4·562281
6	6·075638	7·729615	8·937719	14·098799	2·660080	3·339920	5·474737
7	7·088244	9·017884	10·427339	16·448599	3·103427	3·896573	6·387194
8	8·100850	10·306153	11·916958	18·798399	3·546773	4·453227	7·299650
9	9·113457	11·594422	13·406578	21·148199	3·990120	5·009880	8·212106

TABLE LXXVE (10).—Weights of various iodides, etc., corresponding to known loss of weight on replacing iodine by bromine.

Loss of Weight on replacing Iodine by Bromine.	Corresponding Weights of					Corresponding Loss on replacing the Iodine by Chlorine.
	I.	HI.	NaI.	KI.	AgI.	
1	2·700915	2·722357	3·191236	3·533716	4·996809	1·94681986
2	5·401829	5·444714	6·382472	7·067432	9·993618	3·89363971
3	8·102744	8·167071	9·573708	10·601149	14·990428	5·84045957
4	10·803659	10·889428	12·764944	14·134865	19·987237	7·78727942
5	13·504573	13·611785	15·956180	17·668581	24·984046	9·73409928
6	16·205488	16·334132	19·147415	21·202297	29·980855	11·68091913
7	18·906403	19·056499	22·338651	24·736014	34·977664	13·62773899
8	21·607318	21·778856	25·529887	28·269730	39·974474	15·57455885
9	24·308232	24·501213	28·721123	31·803446	44·971283	17·52137870
10	27·009147	27·223569	31·912359	35·337162	49·968092	19·46819856
11	29·710062	29·945926	35·103595	38·870879	54·964901	
12	32·410976	32·668283	38·294831	42·404595	59·961710	
13	35·111891	35·390640	41·486067	45·938311	64·958519	
14	37·812806	38·112997	44·677303	49·472027	69·955329	
15	40·513720	40·835354	47·868539	53·005743	74·952138	
16	43·214635	43·557711	51·059774	56·539460	79·948947	
17	45·915550	46·280068	54·251010	60·073176	84·945756	
18	48·616465	49·002425	57·442246	63·606892	89·942565	
19	51·317379	51·724782	60·633482	67·140608	94·939375	
20	54·018294	54·447139	63·824718	70·674325	99·936184	
21	56·719209	57·169496	67·015954	74·208041		
22	59·420123	59·891853	70·207190	77·741757		
23	62·121038	62·614210	73·398426	81·275473		
24	64·821953	65·336567	76·589662	84·809190		
25	67·522867	68·058924	79·781898	88·342906		
26	70·223782	70·781281	82·973133	91·876622		
27	72·924697	73·503638	86·164369	95·310338		
28	75·625612	76·225995	89·355605	98·944054		
29	78·326526	78·948351	92·546841			

TABLE LXXVE (10)—*continued.*

Loss of Weight on replacing Iodine by Bromine.	Corresponding Weights of					Corresponding Loss on replacing the Iodine by Chlorine.
	I.	HI.	NaI.	KI.	AgI.	
30	81·027441	81·670708	95·737077			
31	83·728356	84·393065	98·928313			
32	86·429270	87·115422				
33	89·130185	89·837779				
34	91·831100	92·560136				
35	94·532014	95·282493				
36	97·232929	98·004850				
37	99·933844					

If a gramme of the substance was taken, and the numbers in the first column denote centigrammes, then the numbers in columns 2 to 6 give the percentages.

Corresponding weights of iodine and various iodides, etc.

I.	HI.	NaI.	KI.	AgI.	Br to replace I.	Loss on replacement by Br.	Cl to replace I.	Loss on replacement by Cl.	Loss on replacement by O.
1	1·007939	1·181539	1·308341	1·850043	0·629755	0·370245	0·279200	0·720800	0·936993
2	2·015878	2·363078	2·616681	3·700087	1·259510	0·740490	0·558400	1·441600	1·873986
3	3·023817	3·544617	3·925022	5·550130	1·889265	1·110735	0·837599	2·162401	2·810979
4	4·031756	4·726156	5·233362	7·400173	2·519020	1·480980	1·116799	2·883201	3·747972
5	5·039694	5·907695	6·541703	9·250217	3·148775	1·851225	1·395999	3·604001	4·684965
6	6·047633	7·089234	7·850043	11·100260	3·778530	2·221470	1·675199	4·324801	5·621958
7	7·055572	8·270773	9·158384	12·950303	4·408285	2·591715	1·954399	5·045601	6·558951
8	8·063511	9·452312	10·466724	14·800347	5·038040	2·961960	2·233598	5·766402	7·495944
9	9·071450	10·633851	11·775065	16·650390	5·667796	3·332204	2·512798	6·487202	8·432937

TABLE LXXVE (11).—Weights of various iodides, etc., corresponding to known loss of weight on replacing iodine by chlorine.

Loss of Weight on replacing I by Cl.	Corresponding Weights of					
	I.	HI.	NaI.	KI.	PbI_2.	AgI.
1	1·387347	1·398361	1·639205	1·771416	2·517701	2·566652
2	2·774694	2·796722	3·278409	3·542832	5·035402	5·133304
3	4·162041	4·195083	4·917614	5·314248	7·553103	7·699956
4	5·549388	5·593444	6·556818	7·085664	10·070804	10·266608
5	6·936735	6·991805	8·196023	8·857080	12·588505	12·833260
6	8·324082	8·390166	9·835227	10·628496	15·106206	15·399913
7	9·711429	9·788527	11·474432	12·399913	17·623907	17·966565
8	11·098776	11·186888	13·113636	14·171329	20·141608	20·533217
9	12·486123	12·585249	14·752841	15·942745	22·659309	23·099869
10	13·873470	13·983610	16·392045	17·714161	25·177011	25·666521
11	15·260817	15·381971	18·031250	19·485577	27·694712	28·233173
12	16·648164	16·780332	19·670454	21·256993	30·212413	30·799825
13	18·035511	18·178693	21·309659	23·028409	32·730114	33·366477
14	19·422858	19·577054	22·948864	24·799825	35·247815	35·933129
15	20·810205	20·975415	24·588068	26·571241	37·765516	38·499781
16	22·197552	22·373776	26·227273	28·342657	40·283217	41·066433
17	23·584900	23·772137	27·866477	30·114073	42·800918	43·633086
18	24·972247	25·170498	29·505682	31·885489	45·318619	46·199738
19	26·359594	26·568859	31·144886	33·656906	47·836320	48·766390
20	27·746941	27·967220	32·784091	35·428322	50·354021	51·333042
21	29·134288	29·365581	34·423295	37·199738	52·871722	53·899694
22	30·521635	30·763942	36·062500	38·971154	55·389423	56·466346
23	31·908982	32·162303	37·701704	40·742570	57·907124	59·032998
24	33·296329	33·560664	39·340909	42·513986	60·424825	61·599650
25	34·683676	34·959025	40·980114	44·285402	62·942526	64·166302
26	36·071023	36·357386	42·619318	46·056818	65·460227	66·732954
27	37·458370	37·755747	44·258523	47·828234	67·977928	69·299606
28	38·845717	39·154108	45·897727	49·599650	70·495629	71·866259
29	40·233064	40·552469	47·536932	51·371066	73·013330	74·432911
30	41·620411	41·950830	49·176136	53·142482	75·531032	76·999563
31	43·007758	43·349191	50·815341	54·913898	78·048733	79·566215
32	44·395105	44·747552	52·454545	56·685315	80·566434	82·132867
33	45·782452	46·145913	54·093750	58·456731	83·084135	84·699519
34	47·169799	47·544274	55·732954	60·228147	85·601836	87·266171
35	48·557146	48·942635	57·372159	61·999563	88·119537	89·832823

TABLE LXXVE (11)—*continued.*

Loss of Weight on replacing I by Cl.	Corresponding Weights of					
	I.	HI.	NaI.	KI.	PbI_2.	AgI.
36	49·944493	50·340996	59·011363	63·770979	90·637238	92·399475
37	51·331840	51·739357	60·650568	65·542395	93·154939	94·966127
38	52·719187	53·137718	62·289773	67·313811	95·672640	97·532779
39	54·106534	54·536079	63·928977	69·085227	98·190341	
40	55·493881	55·934440	65·568182	70·856643		
41	56·881228	57·332801	67·207386	72·628059		
42	58·268575	58·731162	68·846591	74·399475		
43	59·655922	60·129523	70·485795	76·170891		
44	61·043269	61·527884	72·125000	77·942308		
45	62·430616	62·926245	73·764204	79·713724		
46	63·817963	64·324606	75·403409	81·485140		
47	65·205310	65·722967	77·042613	83·256556		
48	66·592657	67·121328	78·681818	85·027972		
49	67·980004	68·519689	80·321022	86·799388		
50	69·367352	69·918050	81·960227	88·570804		
51	70·754699	71·316412	83·599432	90·342220		
52	72·142046	72·714773	85·238636	92·113636		
53	73·529393	74·113134	86·877841	93·885052		
54	74·916740	75·511495	88·517015	95·656468		
55	76·304087	76·909856	90·156250	97·427884		
56	77·691434	78·308217	91·795454	99·199300		
57	79·078781	79·706578	93·434659			
58	80·466128	81·104939	95·073863			
59	81·853475	82·503300	96·713068			
60	83·240822	83·901661	98·352272			
61	84·628169	85·300022	99·991477			
62	86·015516	86·698383				
63	87·402863	88·096744				
64	88·790210	89·495105				
65	90·177557	90·893466				
66	91·564904	92·291827				
67	92·952251	93·690188				
68	94·339598	95·088549				
69	95·726945	96·486910				
70	97·114292	97·885271				
71	98·501639	99·283632				
72	99·888986					

If a gramme of the substance was taken, and the numbers in the first column denote centigrammes, then the numbers in columns 2 to 7 give percentages.

TABLE LXXVE (12).—Weight in mgms. of $Na_2S_2O_3$ in a mixture containing $Na_2S_2O_3$ and Na_2SO_3 calculated from titrations of equal weights, (1) against $N/10KMnO_4$ solution, and (2) against N/10 iodine.

Digest first portion with a known volume (excess) of $KMnO_4$. After a time add a known volume (excess) of $N/10FeSO_4$ solution and titrate back with $N/10KMnO_4$. Titrate the second portion against iodine in the usual way.

Putting O = volume in cm^3. of $N/10KMnO_4$ actually used up by the mixture, *i.e.* total volume *minus* that corresponding to the $FeSO_4$.
I = volume in centimetre cubes of N/10 iodine used.

$$Na_2S_2O_3 + 2O_2 + H_2O = Na_2SO_4 + H_2SO_4.$$
$$2Na_2S_2O_3 + I_2 = Na_2S_4O_6 + 2NaI.$$

One gramme $Na_2S_2O_3 \equiv 505{\cdot}625$ cm^3. $N/10KMnO_4$ solution.
$\equiv$ 63·203 „ „ iodine solution.

So weight of $Na_2S_2O_3 \equiv (O - I) \times 0{\cdot}00226029$ grms.

(O - I) ccms.	Decimals of 1 cm³.									
	0	1	2	3	4	5	6	7	8	9
0		0·2260	0·4521	0·6781	0·9041	1·1301	1·3562	1·5822	1·8082	2·0343
1	2·2603	2·4863	2·7123	2·9384	3·1644	3·3904	3·6165	3·8425	4·0685	4·2945
2	4·5206	4·7466	4·9726	5·1987	5·4217	5·6507	5·8767	6·1028	6·3288	6·5548
3	6·7809	7·0069	7·2329	7·4859	7·6850	7·9110	8·1370	8·3631	8·5891	8·8151
4	9·0411	9·2672	9·4932	9·7192	9·9453	10·1713	10·3973	10·6233	10·8494	11·0754
5	11·3014	11·5275	11·7535	11·9795	12·2055	12·4316	12·6576	12·8836	13·1097	13·3357
6	13·5617	13·7877	14·0138	14·2398	14·4658	14·6919	14·9179	15·1439	15·3699	15·5960
7	15·8220	16·0480	16·2741	16·5001	16·7261	16·9521	17·1782	17·4042	17·6302	17·8562
8	18·0823	18·3083	18·5343	18·7604	18·9864	19·2124	19·4385	19·6645	19·8905	20·1165
9	20·3426	20·5686	20·7946	21·0207	21·2467	21·4727	21·6987	21·9248	22·1508	22·3768
10	22·6029	22·8289	23·0549	23·2809	23·5070	23·7330	23·9590	24·1851	24·4111	24·6371
11	24·8631	25·0892	25·3152	25·5412	25·7673	25·9933	26·2193	26·4453	26·6714	26·8974
12	27·1234	27·3495	27·5755	27·8015	28·0276	28·2536	28·4796	28·7056	28·9317	29·1577
13	29·3837	29·6097	29·8358	30·0618	30·2878	30·5139	30·7399	30·9659	31·1919	31·4179
14	31·6440	31·8700	32·0961	32·3221	32·5481	32·7741	33·0002	33·2262	33·4522	33·6783
15	33·9043	34·1303	34·3563	34·5824	34·8084	35·0344	35·2605	35·4865	35·7125	35·9385
16	36·1646	36·3906	36·6166	36·8427	37·0687	37·2947	37·5207	37·7468	37·9728	38·1988
17	38·4249	38·6509	38·8769	39·1029	39·3289	39·5550	39·7810	40·0071	40·2331	40·4591
18	40·6851	40·9112	41·1372	41·3632	41·5893	41·8153	42·0413	42·0673	42·4934	42·7194
19	42·9454	43·1715	43·3975	43·6235	43·8495	44·0756	44·3016	44·5276	44·7537	44·9797
20	45·2057	45·4317	45·6578	45·8838	46·1098	46·3359	46·5619	46·7879	47·0139	47·2399
21	47·4660	47·6920	47·9181	48·1441	48·3701	48·5961	48·8222	49·0482	49·2742	49·5003
22	49·7263	49·9523	50·1783	50·4044	50·6304	50·8684	51·0825	51·3085	51·5345	51·7605
23	51·9866	52·2126	52·4386	52·6647	52·8907	53·1167	53·3427	53·5688	53·7948	54·0208
24	54·2469	54·4729	54·6989	54·9249	55·1510	55·3770	55·6030	55·8290	56·0551	56·2811

TABLE LXXVE (12)—*continued.*

(O − I) ccms.	Decimals of 1 cm³.									
	0	1	2	3	4	5	6	7	8	9
25	56·5071	56·7332	56·9592	57·1852	57·4113	57·6373	57·8633	58·0893	58·3154	58·5414
26	58·7674	58·9935	59·2195	59·4455	59·6715	59·8976	60·1236	60·3496	60·5757	60·8017
27	61·0277	61·2537	61·4798	61·7058	61·9318	62·1579	62·3839	62·6099	62·8359	63·0620
28	63·2880	63·5140	63·7401	63·9661	64·1921	64·4181	64·6442	64·8702	65·0962	65·3223
29	65·5483	65·7743	66·0003	66·2264	66·4524	66·6784	66·9045	67·1305	67·3565	67·5825
30	67·8086	68·0346	68·2606	68·4867	68·7127	68·9387	69·1647	69·3908	69·6168	69·8428
31	70·0689	70·2949	70·5209	70·7469	70·9730	71·1990	71·4250	71·6511	71·8771	72·1031
32	72·3291	72·5552	72·7812	73·0072	73·2333	73·4593	73·6853	73·9113	74·1374	74·3634
33	74·5894	74·8155	75·0415	75·2675	75·4935	75·7196	75·9456	76·1716	76·3977	76·6237
34	76·8497	77·0757	77·3018	77·5278	77·7538	77·9799	78·2059	78·4319	78·6579	78·8840
35	79·1100	79·3360	79·5621	79·7881	80·0141	80·2401	80·4662	80·6922	80·9182	81·1443
36	81·3703	81·5963	81·8223	82·0484	82·2744	82·5004	82·7265	82·9525	83·1785	83·4045
37	83·6306	83·8566	81·0826	84·3087	84·5347	84·7607	84·9867	85·2128	85·4388	85·6648
38	85·8909	86·1169	86·3429	86·5689	86·7950	87·0210	87·2470	87·4731	87·6991	87·9251
39	88·1511	88·3772	88·6032	88·8292	89·0553	89·2813	89·5073	89·7333	89·9594	90·1854
40	90·4114	90·6375	90·8635	91·0895	91·3155	91·5416	91·7676	91·9936	92·2197	92·4457
41	92·6717	92·8977	93·1238	93·3498	93·5758	93·8019	94·0279	94·2539	94·4799	94·7060
42	94·9320	95·1580	95·3841	95·6101	95·8361	96·0621	96·2882	96·5142	96·7402	96·9663
43	97·1923	97·4183	97·6443	97·8704	98·0964	98·3224	98·5485	98·7745	99·0005	99·2265
44	99·4526	99·6786	99·9046							

If 0·1 grm. of the substance was employed, then the numbers in this table give the percentages of $Na_2S_2O_3$. If only $Na_2S_2O_3$ and Na_2SO_3 be present, the weight of $NaSO_3$ is best obtained by subtracting the weight of $Na_2S_2O_3$ as given in the table from the weight of mixture used; when any other substance is present in the mixture, such other substance having no action on the standard solutions employed—then weight of $Na_2SO_3 = \frac{1}{7}\,(8I - O) \times 0{\cdot}006308$.

0·1 grm. $Na_2S_2O_3 \equiv 50{\cdot}5625$ cm³. N/10 $KMnO_4 \equiv 6{\cdot}3203$ cm³. N/10I.

TABLE LXXVE (13).—Percentage of Na_2SO_4 in a mixture of K_2SO_4 and Na_2SO_4 calculated from the weight of $BaSO_4$, corresponding to 1 grm. of the mixture.

1 grm. $K_2SO_4 \equiv 1{\cdot}338954$ grm. $BaSO_4$.
1 „ $Na_2SO_4 \equiv 1{\cdot}642234$ „ $BaSO_4$.

Weight of Na_2SO_4 per 1 grm. of mixture $= (W - 1{\cdot}338954) \times 3{\cdot}297281$, where W = weight of $BaSO_4$.

Weight of $BaSO_4$ Centigrammes.	Milligrammes.									
	0	1	2	3	4	5	6	7	8	9
133										0·0152
134	0·3449	0·6747	1·0044	1·3341	1·6638	1·9936	2·3233	2·6530	2·9828	3·3125
135	3·6422	3·9719	4·3017	4·6314	4·9611	5·2908	5·6206	5·9503	6·2800	6·6098
136	6·9395	7·2692	7·5989	7·9287	8·2584	8·5881	8·9179	9·2476	9·5773	9·9070
137	10·2368	10·5665	10·8962	11·2260	11·5557	11·8854	12·2151	12·5449	12·8746	13·2043
138	13·5341	13·8638	14·1935	14·5232	14·8530	15·1827	15·5124	15·8421	16·1719	16·5016
139	16·8313	17·1611	17·4908	17·8205	18·1502	18·4780	18·8097	19·1394	19·4692	19·7989
140	20·1286	20·4583	20·7881	21·1178	21·4475	21·7773	22·1070	22·4367	22·7664	23·0962
141	23·4259	23·7556	24·0851	24·4151	24·7448	25·0745	25·4043	25·7340	26·0637	26·3934
142	26·7232	27·0529	27·3826	27·6124	28·0421	28·2718	28·6015	29·0313	29·3610	29·6907
143	30·0205	30·3502	30·6799	31·0096	31·3394	31·6691	31·9988	32·3286	32·6583	32·9880
144	33·3177	33·6475	33·9772	34·3069	34·6366	34·9664	35·2961	35·6258	35·9556	36·2853
145	36·6150	36·9447	37·2745	37·6042	37·9339	38·2637	38·5934	38·9231	39·2528	39·5826
146	39·9123	40·2420	40·5718	40·9015	41·2312	41·5609	41·8907	42·2204	42·5501	42·8799
147	43·2096	43·5393	43·8690	41·1988	44·5285	44·8582	45·1879	45·5177	45·8474	46·1771
148	46·5069	46·8366	47·1663	47·4960	47·8258	48·1555	48·4852	48·8150	49·1447	49·4744
149	49·8041	50·1339	50·4636	50·7933	51·1231	51·4528	51·7825	52·1122	52·4420	52·7717
150	53·1014	53·4312	53·7609	54·0906	54·4203	54·7501	55·0798	55·4095	55·7392	56·0690
151	56·3987	56·7284	57·0582	57·3879	57·7176	58·0473	58·3771	58·7068	59·0365	59·3668
152	59·6960	60·0257	60·3554	60·6852	61·0149	61·3446	61·6744	62·0041	62·3338	62·6635
153	62·9933	63·3230	63·6527	63·9824	64·3122	64·6419	64·9716	65·3014	65·6311	65·9608
154	66·2905	66·6203	66·9500	67·2797	67·6095	67·9392	68·2689	68·5986	68·9284	69·2581
155	69·5878	69·9176	70·2473	70·5770	70·9067	71·2365	71·5662	71·8959	72·2257	72·5554
156	72·8851	73·2148	73·5446	73·8743	74·2040	74·5337	74·8635	75·1932	75·5229	75·8527
157	76·1824	76·5121	76·8418	77·1716	77·5013	77·8310	78·1608	78·4905	78·8202	79·1499
158	79·4797	79·8094	80·1391	80·4689	80·7986	81·1283	81·4580	81·7878	82·1175	82·4472
159	82·7770	83·1067	83·4364	83·7661	84·0959	84·4256	84·7553	85·0850	85·4148	85·7445
160	86·0742	86·4040	86·7337	87·0634	87·3931	87·7229	88·0526	88·3823	88·7121	89·0418
161	89·3715	89·7012	90·0310	90·3607	90·6904	91·0202	91·3499	91·6796	92·0093	92·3391
162	92·6688	92·9985	93·3282	93·6580	93·9877	94·3174	94·6472	94·9769	95·3066	95·6363
163	95·9661	96·2958	96·6255	96·9553	97·2850	97·6147	97·9444	98·2742	98·6039	98·9336
164	99·2634	99·5931	99·9228							

Change in percentage of Na_2SO_4 for every tenth of a milligramme change in weight of $BaSO_4$ corresponding to 1 grm. of mixture.

Weight, mgms.	Percentages.	Weight, mgms.	Percentages.
0·1	0·032973	0·6	0·197837
0·2	065946	0·7	230810
0·3	098918	0·8	263782
0·4	131891	0·9	296755
0·5	164864	1·0	329728

TABLE LXXVE (14).—Weights of various chlorides, etc., corresponding to known gain in weight on replacing 2Cl by SO_4.

Gain in Weight on replacing 2Cl by SO_4.	Corresponding Weights of								
	Cl.	HCl.	LiCl.	NaCl.	KCl.	AgCl.	$CaCl_2$.	$BaCl_2$.	$PbCl_2$.
1	2·817965	2·898092	3·376789	4·650238	5·930048	11·791913	4·411765	8·279014	11·041335
2	5·635930	5·796184	6·753577	9·300477	11·860095	23·589825	8·823529	16·558029	22·082671
3	8·453895	8·694277	10·130366	13·950715	17·790143	35·381738	13·235294	24·837043	33·124006
4	11·271860	11·592369	13·507154	18·600954	23·720191	47·179650	17·647059	33·116057	44·165342
5	14·089825	14·490461	16·883943	23·251192	29·650238	58·974563	22·058824	41·395072	55·206677
6	16·907790	17·388553	20·260731	27·901431	35·580286	70·769475	26·470588	49·674086	66·248013
7	19·725755	20·286645	23·637520	32·551669	41·510334	82·564388	30·882353	57·953100	77·289348
8	22·543720	23·184738	27·014308	37·201908	47·440382	94·359300	35·294118	66·232114	88·330684
9	25·361685	26·082830	30·391097	41·852146	53·370429	106·154213	39·705882	74·511129	99·372019

TABLE LXXVE (15).—Weights of various bromides, etc., corresponding to known loss of weight on replacing 2Br by SO_4.

Loss on replacing 2Br by SO_4.	Corresponding Weights of						
	Br.	HBr.	NaBr.	KBr.	AgBr.	$CaBr_2$.	$PbBr_2$.
1	1·703814	1·725293	2·194971	2·538035	4·003622	2·131046	3·908161
2	3·407628	3·450586	4·389912	5·076071	8·007245	4·262092	7·816322
3	5·111443	5·175879	6·581914	7·614106	12·010867	6·393139	11·724483
4	6·815257	6·901172	8·779885	10·152141	16·014490	8·524185	15·632644
5	8·519071	8·626465	10·974856	12·690177	20·018112	10·655231	19·540805
6	10·222885	10·351758	13·169827	15·228212	24·021734	12·786277	23·448967
7	11·926699	12·077051	15·364799	17·766248	28·025357	14·917321	27·357128
8	13·630514	13·802344	17·559770	20·304283	32·028979	17·048370	31·265289
9	15·334328	15·527637	19·754741	22·842318	36·032602	19·179116	35·173150

TABLE LXXVE (16).—Weights of various iodides, etc., corresponding to known loss of weight on replacing 2I by SO_4.

Loss on replacing 2I by SO_4.	Corresponding Weights of					
	I.	HI.	NaI.	KI.	AgI.	PbI_2.
1	1·608437	1·621206	1·900431	2·101383	2·975678	2·918926
2	3·216874	3·242412	3·800861	4·208766	5·951355	5·837852
3	4·825310	4·863618	5·701292	6·313149	8·927033	8·756777
4	6·433747	6·484824	7·601723	8·417532	11·902711	11·675703
5	8·042184	8·106030	9·502154	10·521915	14·878389	14·594629
6	9·650621	9·727236	11·402584	12·626298	17·854066	17·513555
7	11·259058	11·348442	13·303015	14·730682	20·829744	20·432480
8	12·867494	12·969648	15·203446	16·835065	23·805422	23·351406
9	14·475931	14·590854	17·103876	18·939448	26·781100	26·270332

TABLE LXXVE (17).—Weights of various nitrates, etc., corresponding to known loss of weight on replacing NO_3 by Cl.

Loss on replacing NO_3 by Cl.	Corresponding Weights of											
	N_2O_5.	HNO_3.	$LiNO_3$.	$NaNO_3$.	KNO_3.	$AgNO_3$.	$Ca(NO_3)_2$.	$Sr(NO_3)_2$.	$Ba(NO_3)_2$.	$Co(NO_3)_2$.	$Cu(NO_3)_2$.	$Pb(NO_3)_2$.
1	2·032343	2·371117	2·597593	3·200075	3·805566	6·392253	3·087251	3·980444	4·916886	3·442648	3·529146	6·223768
2	4·064686	4·742234	5·195186	6·400150	7·611132	12·784505	6·174502	7·960888	9·833772	6·885295	7·058293	12·447537
3	6·097029	7·113351	7·792779	9·600226	11·416698	19·176758	9·261753	11·941331	14·750658	10·327943	10·587439	18·671305
4	8·129372	9·484468	10·390372	12·800301	15·222264	25·569011	12·349003	15·921775	19·667544	13·770590	14·116585	24·895073
5	10·161715	11·855585	12·987965	16·000376	19·027830	31·961264	15·436254	19·902219	24·584430	17·213238	17·645731	31·118842
6	12·194058	14·226702	15·585558	19·200451	22·833396	38·353516	18·523505	23·882663	29·501316	20·655886	21·174878	37·342610
7	14·226401	16·597819	18·183152	22·400526	26·638962	44·745769	21·610756	27·863106	34·418202	24·098533	24·704024	43·566378
8	16·258744	18·968936	20·780745	25·600602	30·444528	51·138022	24·698007	31·843550	39·335088	27·541181	28·233170	49·790147
9	18·291087	21·340053	23·378338	28·800677	34·250094	57·530275	27·785258	35·823994	44·251974	30·983828	31·762317	56·013915

TABLE LXXVE (18).—Weights of various nitrates, etc., corresponding to known loss of weight on replacing $2NO_3$ by SO_4.

Loss on replacing $2NO_3$ by SO_4.	Corresponding Weights of											
	N_2O_5.	HNO_3.	$LiNO_3$.	$NaNO_3$.	KNO_3.	$AgNO_3$.	$Ca(NO_3)_2$.	$Sr(NO_3)_2$.	$Ba(NO_3)_2$.	$Co(NO_3)$.	$Cu(NO_3)_2$.	$Pb(NO_3)_2$.
1	3·857245	4·500214	4·930050	6·073519	7·222698	12·132049	5·859386	7·554604	9·331906	6·533904	6·698073	11·812277
2	7·714490	9·000428	9·860100	12·147038	14·445396	24·264097	11·718772	15·109208	18·663812	13·067809	13·396146	23·624554
3	11·571734	13·500642	14·790150	18·220557	21·668094	36·396146	17·578158	22·663812	27·995717	19·601713	20·094218	35·436831
4	15·428980	18·000857	19·720200	24·294076	28·890792	48·528194	23·437545	30·218415	37·327623	26·135617	26·792291	47·249108
5	19·286224	22·501071	24·650250	30·367595	36·113490	60·660243	29·296931	37·773019	46·659529	32·669522	33·490364	59·061385
6	23·143469	27·001285	29·580300	36·441113	43·336188	72·792291	35·156317	45·327623	55·991435	39·203426	40·188437	70·873662
7	27·000714	31·501499	34·510350	42·514632	50·558886	84·924340	41·015703	52·882227	65·323340	45·737330	46·886510	82·685939
8	30·857959	36·001713	39·440400	48·588151	57·781585	97·056388	46·875089	60·436831	74·655246	52·271235	53·584582	94·498216
9	34·715203	40·501927	44·370450	54·661670	65·004283	109·188437	52·734475	67·991435	83·987152	58·805139	60·282655	106·310493

TABLE LXXVE (19).—Weights of various carbonates, etc., corresponding to gain in weight on replacing CO_3 by 2Cl.

Gain on replacing CO_3 by 2Cl.	Corresponding Weights of											
	CO_2.	Li_2CO_3.	Na_2CO_3.	K_2CO_3.	$MgCO_3$.	$CaCO_3$.	$SrCO_3$.	$BaCO_3$.	$MnCO_3$.	$ZnCO_3$.	$CuCO_3$.	$Pb(CO_3)_2$.
1	4·036697	6·794495	9·733945	12·688073	7·739450	9·183486	13·541284	18·110092	10·550459	11·504587	11·339450	24·486239
2	8·073395	13·588991	19·467890	25·376147	15·478899	18·366972	27·082569	36·220183	21·100917	23·009174	22·678899	48·972477
3	12·110092	20·383486	29·201835	38·064220	23·218349	27·550459	40·623853	54·330275	31·651376	34·513761	34·018349	73·458716
4	16·146789	27·177982	38·935780	50·752294	30·957798	36·733945	54·165138	72·440367	42·201835	46·018349	45·357798	97·944954
5	20·183486	33·972477	48·669725	63·440367	38·697248	45·917431	67·706422	90·550459	52·752294	57·522936	56·697248	122·431193
6	24·220184	40·766972	58·403670	76·128440	46·436697	55·100917	81·247706	108·660550	63·302752	69·027523	68·036697	146·917431
7	28·256881	47·561468	68·137615	88·816514	54·176147	64·284404	94·788991	126·770642	73·853211	80·532110	79·376147	171·403670
8	32·293578	54·355963	77·871560	101·504587	61·915596	73·467890	108·330275	144·880734	84·403670	92·036697	90·715596	195·889908
9	36·330275	61·150459	87·605505	114·192661	69·655046	82·651376	121·871560	162·990826	94·954128	103·541284	102·055046	220·376147

TABLE LXXVE (20).—Weights of various carbonates, etc., corresponding to known gain in weight when CO_3 is replaced by SO_4.

Gain on replacing CO_3 by SO_4.	Corresponding Weights of											
	CO_2.	Li_2CO_3.	Na_2CO_3.	K_2CO_3.	$MgCO_3$.	$CaCO_3$.	$SrCO_3$.	$BaCO_3$.	$MnCO_3$.	$ZnCO_3$.	$CuCO_3$.	$PbCO_3$.
1	1·220189	2·053799	2·942318	3·835275	2·339434	2·775929	4·093178	5·474210	3·189129	3·477537	3·427621	7·401553
2	2·440377	4·107598	5·884637	7·670549	4·678869	5·551858	8·186356	10·948419	6·378258	6·955075	6·855241	14·803106
3	3·660566	6·161398	8·826955	11·505824	7·018303	8·327787	12·279534	16·422629	9·567388	10·432612	10·282862	22·204659
4	4·880754	8·215297	11·769273	15·341098	9·357737	11·103716	16·372712	21·896839	12·756517	13·910150	13·710483	29·606212
5	6·100943	10·268996	14·711592	19·176373	11·697171	13·879645	20·465890	27·371048	15·945646	17·387687	17·138103	37·007765
6	7·321131	12·322795	17·653910	23·011647	14·036606	16·655574	24·559068	32·845258	19·134775	20·865225	20·565724	44·409318
7	8·541320	14·376595	20·596229	26·846922	16·376040	19·431503	28·652246	38·319468	22·323905	24·342762	23·993344	51·810871
8	9·761509	16·430394	23·538547	30·682196	18·715474	22·207432	32·745424	43·793677	25·513034	27·820300	27·420965	59·212424
9	10·981697	18·484193	26·480865	34·517471	21·054909	24·983361	36·838602	49·267887	28·702163	31·297837	30·848586	66·613977

TABLE LXXVE (21).—Weights of various carbonates corresponding to known weights of CO_2.

Weight of CO_2.	Corresponding Weights of											
	Li_2CO_3.	Na_2CO_3.	K_2CO_3.	$MgCO_3$.	$CaCO_3$.	$SrCO_3$.	$BaCO_3$.	$MnCO_3$.	$ZnCO_3$.	$CuCO_3$.	$PbCO_3$.	$Bi_2(CO_3)_3$.
1	1·683182	2·411364	3·143182	1·917273	2·275000	3·354545	4·486364	2·613636	2·850000	2·809091	6·065909	4·522727
2	3·366364	4·822727	6·286364	3·834545	4·550000	6·709091	8·972727	5·227273	5·700000	5·618182	12·131818	9·045455
3	5·049545	7·234091	9·429545	5·751818	6·825000	10·063636	13·459091	7·840909	8·550000	8·427273	18·197727	13·568182
4	6·732727	9·645455	12·572727	7·669091	9·100000	13·418182	17·945455	10·454545	11·400000	11·236364	24·263636	18·090909
5	8·415909	12·056818	15·715909	9·586364	11·375000	16·772727	22·431818	13·068182	14·250000	14·045455	30·329545	22·613636
6	10·099091	14·468182	18·859091	11·503636	13·650000	20·127273	26·918182	15·681818	17·100000	16·854545	36·395455	27·136364
7	11·782273	16·879545	22·002273	13·420909	15·925000	23·481818	31·404545	18·295455	19·950000	19·663636	42·461364	31·659091
8	13·465455	12·290909	25·145455	15·338182	18·200000	26·836364	35·890909	20·909091	22·800000	22·472727	48·527273	36·181818
9	15·148636	21·702273	28·288636	17·255455	20·475000	30·190909	40·377273	23·522727	25·650000	25·281818	54·593182	40·704545

TABLE LXXVE (22).—Weights in mgms. of various carbonates, etc., corresponding to 1 cm^3. of dry CO_2 measured at 0° C.

	C.	Li_2CO_3.	Na_2CO_3.	K_2CO_3.	$MgCO_3$.	$CaCO_3$.	$SrCO_3$.	$BaCO_3$.	$MnCO_3$.	$ZnCO_3$.	$CuCO_3$.	$PbCO_3$.	$Bi_2(CO_3)_3$.
In London under 760 mms., . . .	0·539581	3·330111	4·770791	6·218666	3·793251	4·501001	6·636841	8·876100	5·170982	5·638617	5·557680	12·001171	8·948044
In Lat. 45° under 760 mms., . . .	0·539267	3·328176	4·768018	6·215051	3·791046	4·498385	6·632983	8·870941	5·167975	5·635339	5·554449	11·994195	8·942843
Under 1 megadyne, .	0·532246	3·284847	4·705945	6·134139	3·741692	4·439822	6·546630	8·755453	5·100694	5·561975	5·482138	11·838046	8·826419

These numbers are all calculated from the actual density of CO_2 and not from the theoretical values. The results obtained by employing the theoretical value for the weight of 1 cm^3. of CO_2 would be about 0·076 per cent. lower.

TABLE LXXVE (23).—Percentage Composition of Mixtures of Two Pure Carbonates calculated from the Gain in Weight when all the CO_3 in one Gramme of the Mixture is replaced by SO_4.

Formula of First Carbonate.	Minimum Gain in Mgms.	Percentage of Second Carbonate for every Milligramme above the Minimum. Formula of Second Carbonate.												
		$Bi_2(CO_3)_3$.	$BaCO_3$.	$SrCO_3$.	K_2CO_3.	$Ce_2(CO_3)_3$.	$ZnCO_3$.	$CuCO_3$.	$FeCO_3$.	$MnCO_3$.	Na_2CO_3.	$CaCO_3$.	$MgCO_3$.	Li_2CO_3.
$PbCO_3$.	135·107	2·1692	2·1023	0·9157	0·7960	0·7379	0·6559	0·6384	0·5681	0·5604	0·4884	0·4442	0·3421	0·2843
$Bi_2(CO_3)_3$.	181·206		*68·0855	1·5847	1·2574	1·1205	0·9403	0·9046	0·7697	0·7555	0·6303	0·5586	0·4061	0·3271
$BaCO_3$.	182·675			1·6225	1·2810	1·1393	0·9534	0·9168	0·7785	0·7640	0·6362	0·5632	0·4085	0·3287
$SrCO_3$.	244·309				†6·0870	†3·8254	2·3121	2·1080	1·4965	1·4439	1·0465	0·8626	0·5460	0·4122
K_2CO_3 .	260·738					*10·2960	†3·7282	†3·2248	1·9844	1·8929	1·2637	1·0050	0·5998	0·4422
$Ce_2(CO_3)_3$.	270·450						†5·8446	†4·6954	2·4582	2·3194	1·4405	1·1137	0·6369	0·4620
$ZnCO_3$.	287·560							*23·8791	†4·2426	†3·8454	1·9117	1·3759	0·7148	0·5016
$CuCO_3$.	291·748								†5·1592	†4·5834	2·0781	1·4600	0·7369	0·5124
$FeCO_3$.	311·130									*41·0689	†3·4797	2·0361	0·8597	0·5689
$MnCO_3$.	313·565										†3·8019	2·1425	0·8781	0·5769
Na_2CO_3 .	339·868											†4·9088	1·1417	0·6801
$CaCO_3$.	360·240												1·4878	0·7895
$MgCO_3$.	427·454													1·6821

In ordinary laboratory practice only one decimal place in the "Minimum" column will be needed; three have been given in order to secure the best possible results where the gain per gramme of mixture is determined by calculation and not by direct experiment.

In the instances where the percentage numbers are marked by an asterisk (*) this method should never be employed; and in those marked † only when no more than a rough approximation is needed.

The following example shows how the table is to be used:—

In a mixture of $BaCO_3$ and $ZnCO_3$ the gain per gramme on replacing CO_3 by SO_4 was found to be 256·8 mgms., *i.e.* 256·8 − 182·7 = 74·1 above the minimum for pure $BaCO_3$.

On the same line as $BaCO_3$ in the column headed $ZnCO_3$ we find 0·9534, therefore

Percentage of $ZnCO_3$ in mixture = 0·9534 × 74·1 = 70·65.

TABLE LXXVE (24).—Percentage Composition of Mixtures of Two Pure Carbonates calculated from the Amount of CO_2 obtainable from one Gramme of the Mixture.

First Carbonate.	Minimum Wt. of CO_2 in Mgms.	Percentage of Second Carbonate for every Mgm. of CO_2 above the Minimum.												
		$Bi_2(CO_3)_3$.	$BaCO_3$.	$SrCO_3$.	K_2CO_3.	$Ce_2(CO_3)_3$.	$ZnCO_3$.	$CuCO_3$.	$FeCO_3$.	$MnCO_3$.	Na_2CO_3.	$CaCO_3$.	$MgCO_3$.	Li_2CO_3.
$PbCO_3$.	164·856	1·7778	1·7229	0·7505	0·6523	0·6055	0·5376	0·5232	0·4656	0·4592	0·4002	0·3640	0·2803	0·2330
$Bi_2(CO_3)_3$.	221·106		*55·7991	1·2987	1·0305	0·9183	0·7706	0·7414	0·6308	0·6192	0·5165	0·4578	0·3328	0·2681
$BaCO_3$.	222·898			1·3297	1·0499	0·9337	0·7814	0·7514	0·6380	0·6261	0·5214	0·4615	0·3348	0·2694
$SrCO_3$.	298·103				†4·9835	†3·1351	1·8949	1·7276	1·2265	1·1834	0·8576	0·7069	0·4475	0·2703
K_2CO_3 .	318·149					†8·4381	†3·0555	†2·6428	1·6263	1·5514	1·0357	0·8236	0·4916	0·3624
$Ce_2(CO_3)_3$.	330·						†4·7899	†3·8431	2·0145	1·9008	1·1506	0·9127	0·5220	0·3786
$ZnCO_3$.	350·877							*19·5700	†3·4770	†3·1514	1·5668	1·1276	0·5858	0·4111
$CuCO_3$.	355·987								†4·2282	†3·7563	1·7031	1·1366	0·6039	0·4199
$FeCO_3$.	379·638									*33·6578	†2·8518	1·6688	0·7045	0·4663
$MnCO_3$.	382·609										†3·1158	1·7559	0·7196	0·4728
Na_2CO_3 .	414·703											†4·0230	0·9357	0·5574
$CaCO_3$.	439·560												1·2193	0·6470
$MgCO_3$.	521·574													1·3786

Here again the mixtures the numbers for which are marked with an asterisk (*) should never be estimated by this method, and those marked † only when merely a rough approximation is needed.

TABLE LXXVE (25).—Weight of AgCl obtainable with one gramme of various substances containing Chlorine.

	Formula of Substance.	Molecular (or Formula) Weight.	Weight of AgCl obtainable by operating on Unit Weight of Substance.		Formula of Substance.	Molecular (or Formula) Weight.	Weight of AgCl obtainable by operating on Unit Weight of Substance.
1	Cl_2	70·90	4·044570	43	$NbCl_3$	200·35	2·146943
2	HCl	36·458	3·932745	44	$CuCl_2$	134·5	2·132045
3	$BeCl_2$	80·	3·584500	45	$TeCl_4$	269·5	2·128089
4	PCl_5	208·25	3·442497	46	$MoCl_3$	202·35	2·125723
5	$LiCl$	42·48	3·375235	47	S_2Cl_2	135·02	2·123834
6	$SiCl_4$	170·2	3·369683	48	$ZnCl_2$	136·3	2·103888
7	SCl_4	173·86	3·298746	49	$RuCl_3$	208·05	2·067484
8	$AlCl_3$	133·45	3·223230	50	$RhCl_3$	209·35	2·054645
9	Si_2Cl_6	269·5	3·195098	51	$GaCl_2$	140·9	2·035202
10	PCl_3	137·35	3·131707	52	K_2RuCl_5	357·25	2·006718
11	$TiCl_4$	189·9	3·030116	53	$TaCl_5$	360·25	1·990007
12	$MgCl_2$	95·26	3·010288	54	$FeCl_3 + 3H_2O$	216·298	1·988645
13	VCl_4	193·	2·971606	55	$InCl_3$	221·35	1·943257
14	SCl_2	102·96	2·785159	56	$(NH_4)_2PtCl_6$	443·644	1·939122
15	$CrCl_3$	158·45	2·714673	57	$SnCl_4 + 2H_2O$	296·832	1·932137
16	NH_4Cl	53·522	2·678898	58	KCl	74·6	1·921984
17	$GeCl_4$	214·3	2·676248	59	Na_2IrCl_6	451·8	1·904117
18	$FeCl_3$	162·25	2·651094	60	$K_2RhCl_5 + H_2O$	376·566	1·903783
19	$NbCl_5$	271·25	2·642949	61	$SbCl_3$	226·55	1·898654
20	$MoCl_5$	273·25	2·623605	62	$BeCl_2 + 4H_2O$	152·064	1·885785
21	$SeCl_4$	221·	2·595113	63	$LiCl + 2H_2O$	78·512	1·826218
22	$CaCl_2$	111·	2·583423	64	$SrCl_2$	158·5	1·809211
23	Fe_2Cl_6	451·3	2·541635	65	$AlCl_3 + 6H_2O$	241·546	1·780779
24	$ZrCl_4$	232·4	2·467814	66	K_2IrCl_6	484·	1·777438
25	$NaCl$	58·5	2·450940	67	K_2PtCl_6	485·8	1·770852
26	$GaCl_3$	176·35	2·439127	68	WCl_4	325·8	1·760344
27	$MoCl_4$	237·8	2·411775	69	K_2PdCl_4	326·6	1·756032
28	$SbCl_5$	297·45	2·410153	70	$LaCl_3$	245·25	1·753884
29	$AsCl_3$	181·35	2·371878	71	$CeCl_3$	246·6	1·744282
30	$LiCl + H_2O$	60·496	2·370074	72	$OsCl_4$	332·8	1·723317
31	$RuCl_4$	243·5	2·355318	73	$MoCl_2$	166·9	1·718155
32	VCl_3	122·1	2·348567	74	$IrCl_4$	334·8	1·713023
33	$PdCl_4$	248·3	2·309787	75	$PtCl_4$	336·6	1·703862
34	$MnCl_2$	125·9	2·277681	76	$CuCl_2 + 2H_2O$	170·532	1·681561
35	$FeCl_2$	126·8	2·261514	77	$SnCl_4 + 5H_2O$	350·88	1·634519
36	$NiCl_2$	129·6	2·212654	78	$PdCl_2$	177·4	1·616460
37	$CoCl_2$	129·9	2·207544	79	$FeCl_3 + 6H_2O$	270·346	1·591072
38	YCl_3	195·35	2·201843	80	$CdCl_2$	183·3	1·564430
39	$SnCl_4$	260·8	2·199080	81	$ThCl_4$	374·3	1·532247
40	K_2RuCl_6	392·7	2·190680	82	$KAuCl_4$	378·15	1·516647
41	WCl_6	396·7	2·168591	83	$SnCl_2$	189·9	1·510058
42	K_2PdCl_6	397·5	2·164226	84	UCl_4	380·3	1·508073

TABLE LXXVB (25)—*continued.*

	Formula of Substance.	Molecular (or Formula) Weight.	Weight of AgCl obtainable by operating on Unit Weight of Substance.		Formula of Substance.	Molecular (or Formula) Weight.	Weight of AgCl obtainable by operating on Unit Weight of Substance.
85	$K_3IrCl_6 + 3H_2O$	577·198	1·490442	**104**	$AuCl_3 + 2H_2O$	339·582	1·266675
86	Rb_2PtCl_6	578·5	1·487087	**105**	UCl_3	344·85	1·247325
87	$F_3Cl_8 + 18H_2O$	775·588	1·478930	**106**	$Na_3IrCl_6 + 12H_2O$	691·042	1·244903
88	$MnCl_2 + 4H_2O$	197·964	1·448546	**107**	$NiCl_2 + 6H_2O$	237·696	1·206415
89	$CuCl$	99·05	1·447552	**108**	$CoCl_2 + 6H_2O$	237·996	1·204894
90	$FeCl_2 + 4H_2O$	198·864	1·441991	**109**	$RbCl$	120·85	1·186429
91	$IrCl_3$	299·35	1·436913	**110**	$BaCl_2 + 2H_2O$	244·332	1·173649
92	$AuCl_3$	303·55	1·417032	**111**	$LaCl_3 + 7H_2O$	371·362	1·158277
93	$SnCl_4 + 8H_2O$	404·928	1·416351	**112**	WCl_2	254·9	1·124990
94	$MgCl_2 + 6H_2O$	203·356	1·410138	**113**	$PtCl_2$	265·7	1·079262
95	$TlCl_3$	310·45	1·385537	**114**	$SrCl_2 + 6H_2O$	266·596	1·075635
96	$KAuCl_4 + 2H_2O$	414·182	1·384705	**115**	$HgCl_2$	270·9	1·058546
97	K_2PtCl_4	414·9	1·382309	**116**	$PbCl_2$	277·8	1·032253
98	$BaCl_2$	208·3	1·376668	**117**	$AgCl$	143·38	1·
99	$BiCl_3$	314·85	1·366174	**118**	$CsCl$	168·45	0·851172
100	$PtCl_4 + 5H_2O$	426·68	1·344145	**119**	UO_2Cl_2	341·4	0·839953
101	$CaCl_2 + 6H_2O$	219·096	1·308833	**120**	$AuCl$	232·65	0·616291
102	$CdCl_2 + 2H_2O$	219·332	1·307424	**121**	$HgCl$	235·45	0·608962
103	$SnCl_2 + 2H_2O$	225·932	1·269231	**122**	$TlCl$	239·55	0·598539

The principal use of the preceding table is for the determination, without separation, of the percentage composition of a mixture of two pure chlorides. The manner of using it can be best understood from the following instance:—

By operating with one gramme of a mixture of caesium chloride and lithium chloride 2·8756 grms. of silver chloride were obtained; find the percentage composition of the mixture.

If the whole gramme had been pure LiCl we should have got 3·375235 grms. of AgCl
" " " CsCl " " 0·851172 " AgCl
Therefore for 100 per cent. of LiCl we get above minimum 2·524063 " AgCl

and every mgm. of AgCl above the minimum 0·851172 grm. corresponds to $\frac{100}{2524 \cdot 063}$ per cent. LiCl, *i.e.* to 0·03961866 per cent. LiCl.

The excess above minimum is 2·8756 − 0·8512 = 2·0244 grms. or 2024·4 mgms.
∴ Percentage of LiCl = 2024·4 × 0·03961866 = 80·204.

A mixture of two chlorides giving anywhere near the same amounts of AgCl should not be tested by this method; the difference between maximum and minimum should be at least 0·1 grm.

Similar tables for sulphates, carbonates, etc., would prove useful in many cases, but the author has in course of computation a series of tables which practically does away with all calculations for mixture of any two pure salts. The following table is only a short excerpt from the table for two chlorides.

TABLE LXXVE (26).—For the Determination of Percentage Composition of Mixtures of two Chlorides, without separation, and with practically no calculation.

W = Weight in grammes of mixture to be employed.
M = Amount to be subtracted from the weight (P) of AgCl obtained from W grms. of mixture.

Then the number of centigrammes in (P – M) gives the percentage of the chloride with the smaller equivalent.

	W.	M.		W.	M.
$HgCl_2$ and $BaCl_2$.	3·14344	3·32748	$CdCl_2$ and $CaCl_2$.	0·98136	1·53527
„ $CdCl_2$.	1·97674	2·09247	„ NH_4Cl	0·89729	1·40375
„ $SrCl_2$.	1·33215	1·41014	„ LiCl .	0·55224	0·86394
„ KCl .	1·15816	1·22596	$SrCl_2$ and KCl .	8·86741	16·04301
„ NaCl .	0·71819	0·76023	„ NaCl .	1·55829	2·81928
„ $CaCl_2$.	0·65579	0·69418	„ $CaCl_2$.	1·29164	2·33684
„ NH_4Cl	0·61715	0·65328	„ NH_4Cl	1·14984	2·08030
„ LiCl .	0·43165	0·45692	„ LiCl .	0·63856	1·15529
$BaCl_2$ and $CdCl_2$.	5·32590	7·33200	KCl and NaCl .	1·89052	3·63354
„ $SrCl_2$.	2·31191	3·18273	„ $CaCl_2$.	1·51185	2·90576
„ KCl .	1·83380	2·52453	„ NH_4Cl	1·32115	2·53924
„ NaCl .	0·93086	1·28149	„ LiCl .	0·68811	1·32254
„ $CaCl_2$.	0·82867	1·14080	NaCl and $CaCl_2$.	7·54812	18·50000
„ NH_4Cl	0·76791	1·05716	„ NH_4Cl	4·38677	10·75171
„ LiCl .	0·50036	0·68883	„ LiCl .	1·08191	2·65169
$CdCl_2$ and $SrCl_2$.	4·08528	6·39113	$CaCl_2$ and NH_4Cl	10·47395	27·05865
„ KCl .	2·79678	4·37537	„ LiCl .	1·26293	3·26267
„ NaCl .	1·12802	1·76471	NH_4Cl and LiCl .	1·43609	3·84713

NOTE.—Where W is so large as to be unmanageable, a half, a third, a fourth, etc., may be taken and P will then be twice, three times, four times, etc., the actual amount of AgCl obtained. When W is very large it may be taken in decigrammes, and each milligramme in (P – M) will then represent 1 per cent. of the second chloride.

TABLE LXXVF (1).—Weights of various Substances corresponding to given Weights of Nitrogen.

	Weights of Nitrogen.								
	1	2	3	4	5	6	7	8	9
	Corresponding Weights of								
Ammonia, NH_3	1·215385	2·430769	3·646154	4·861538	6·076923	7·292308	8·507692	9·723077	10·938462
Am. chloride, NH_4Cl . . .	3·812108	7·624217	11·436325	15·248433	19·060541	22·872650	26·684758	30·496866	34·308974
Am. sulphate, $(NH_4)_2SO_4$ . .	4·708120	9·416239	14·124359	18·832479	23·540598	28·248718	32·956838	37·664957	42·373077
Nitric acid, HNO_3	4·490598	8·981197	13·471795	17·962393	22·452991	26·943590	31·434188	35·924786	40·415385
Sodium nitrate, $NaNO_3$ . . .	6·060541	12·121083	18·181624	24·242165	30·302707	36·363248	42·423789	48·484330	54·544872
Potassium nitrate, KNO_3 . .	7·207265	14·414530	21·621795	28·829060	36·036225	43·243590	50·450855	57·658120	64·865385
Cyanogen, C_2N_2	1·854701	3·709402	5·564103	7·418803	9·273504	11·128205	12·982906	14·837607	16·692308
Prussic acid, HCN	1·926496	3·852991	5·779487	7·705983	9·632479	11·558974	13·485470	15·411966	17·338462
Pot. cyanide, KCN	4·643162	9·286325	13·929487	18·572650	23·215812	27·858974	32·502137	37·145299	41·788462
Urea, $CO(NH_2)_2$	2·140741	4·281481	6·422222	8·562963	10·703704	12·844444	14·985185	17·125926	19·266667
Uric acid, $C_5H_4N_4O_3$	2·994872	5·989744	8·984615	11·979487	14·974359	17·969231	20·964103	23·958974	26·953846
Albumen (average % of N, 16·1225). .	6·2025	12·4050	18·6075	24·8100	31·0125	37·2150	43·4175	49·6200	55·8225
Nitroglycerol, $C_3H_5(NO_3)_3$ . .	5·393162	10·786325	16·179487	21·572650	26·965812	32·358974	37·752137	43·145299	48·538462

TABLE LXXV$_F$ (2).—Weights of various Substances corresponding to given Volumes of pure dry Nitrogen as measured at 0° C. under 760 mms. pressure.

	Centimetre Cubes of Nitrogen.								
	1	2	3	4	5	6	7	8	9
	Corresponding Weights of								
Ammonia,	1·529242	3·058484	4·587726	6·116968	7·646209	9·175451	10·704693	12·233935	13·763177
Am. chloride,	4·807828	9·615655	14·423483	19·231310	24·039138	28·846965	33·654793	38·462620	43·270448
Am. sulphate,	5·923930	11·847861	17·771791	23·695721	29·619652	35·543582	41·467512	47·391443	53·315373
Nitric acid,	5·650237	11·300474	16·950711	22·600948	28·251185	33·901422	39·551658	45·201895	50·852132
Sodium nitrate,	7·625597	15·251195	22·876792	30·502389	38·127987	45·753584	53·379181	61·004779	68·630376
Potassium nitrate,	9·068447	18·136895	27·205342	36·273790	45·342237	54·410685	63·479132	72·547579	81·616027
Cyanogen,	2·333653	4·667306	7·000960	9·334613	11·668266	14·001919	16·335573	18·669226	21·002879
Prussic acid,	2·423988	4·847976	7·271965	9·695953	12·119941	14·543929	16·967917	19·391906	21·815894
Pot. cyanide,	5·842199	11·684397	17·526596	23·368795	29·210994	35·053192	40·895391	46·737590	52·579788
Urea,	2·693559	5·387118	8·080678	10·774237	13·467796	16·161355	18·854914	21·548474	24·242033
Uric acid,	3·768259	7·536517	11·304776	15·073034	18·841293	22·609551	26·377810	30·146068	33·914327
Albumen,	7·804215	15·608430	23·412645	31·216860	39·021075	46·825290	54·629505	62·433720	70·237935
Nitroglycerol,	6·785876	13·571753	20·357629	27·143506	33·929382	40·715259	47·501135	54·287012	61·072888

For example, 54·76 cm^3. of gas saturated with aqueous vapour at 17° C. under 757 mms. pressure correspond, by Table LIX$_H$, to $54·76 \times 0·917133 = 50·222203$ cm^3. of pure dry nitrogen at 0° C. under 760 mms. pressure; and this by Table LXXV$_F$ (2). corresponds to $339·29382 + 1·35718 + 0·13572 + 0·01357 + 0·00136 + 0·00020 = 340·802$ mgms. of Nitroglycerol.

TABLE LXXVI.—**ALCOHOLOMETRY.**

A. Volume Percentage—measured at $15\frac{5}{9}$° C., 60° F., or $12\frac{4}{9}$° R.—according to the Reading of Tralles' Alcoholometer. (Brix.)

Temperature.	Readings of Alcoholometer.																
	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57
−10° C.	51·7	52·6	53·5	54·3	55·2	56·1	57·0	57·9	58·8	59·7	60·6	61·5	62·5	63·4	64·3	65·3	66·2
8	50·8	51·7	52·6	53·5	54·4	55·3	56·2	57·1	58·0	58·9	59·8	60·7	61·7	62·6	63·6	64·5	65·4
6	49·9	50·8	51·7	52·6	53·5	54·5	55·4	56·3	57·2	58·1	59·0	59·9	60·9	61·8	62·8	63·7	64·7
4	49·0	49·9	50·8	51·8	52·7	53·6	54·5	55·4	56·4	57·3	58·2	59·1	60·1	61·0	62·0	62·9	63·9
− 2	48·1	49·0	49·9	50·9	51·8	52·7	53·7	54·6	55·5	56·5	57·4	58·4	59·3	60·2	61·2	62·1	63·1
0	47·0	48·0	48·9	49·9	50·8	51·8	52·7	53·7	54·6	55·6	56·5	57·5	58·5	59·4	60·4	61·4	62·3
+ 2	46·0	47·0	48·0	49·0	50·0	50·9	51·9	52·8	53·8	54·7	55·7	56·6	57·6	58·6	59·5	60·5	61·5
4	45·1	46·1	47·0	48·0	49·0	50·0	50·9	51·9	52·9	53·8	54·8	55·8	56·7	57·7	58·7	59·6	60·6
6	44·1	45·1	46·1	47·1	48·0	49·0	50·0	51·0	52·0	52·9	53·9	54·9	55·9	56·9	57·8	58·8	59·8
8	43·1	44·1	45·1	46·1	47·1	48·1	49·1	50·1	51·1	52·1	53·0	54·0	55·0	56·0	57·0	57·9	58·9
10	42·2	43·2	44·2	45·2	46·2	47·2	48·1	49·1	50·1	51·1	52·1	53·1	54·1	55·1	56·1	57·1	58·1
12	41·2	42·2	43·2	44·2	45·2	46·2	47·2	48·2	49·2	50·2	51·2	52·2	53·2	54·2	55·2	56·2	57·2
14	40·2	41·2	42·2	43·2	44·2	45·2	46·2	47·3	48·3	49·3	50·3	51·3	52·3	53·3	54·4	55·4	56·4
16	39·2	40·2	41·3	42·3	43·3	44·3	45·3	46·3	47·3	48·4	49·4	50·4	51·4	52·4	53·5	54·5	55·5
18	38·2	39·2	40·3	41·3	42·3	43·3	44·3	45·4	46·4	47·4	48·5	49·5	50·5	51·5	52·6	53·6	54·6
20	37·2	38·3	39·3	40·2	41·3	42·3	43·4	44·4	45·4	46·5	47·5	48·5	49·6	50·6	51·6	52·7	53·7
22	36·2	37·3	38·3	39·3	40·4	41·4	42·4	43·4	44·5	45·5	46·5	47·6	48·6	49·7	50·7	51·7	52·7
24	35·2	36·2	37·3	38·3	39·3	40·4	41·4	42·4	43·5	44·5	45·5	46·6	47·6	48·6	49·7	50·7	51·8
26	34·2	35·2	36·2	37·3	38·3	39·4	40·4	41·5	42·5	43·5	44·6	45·6	46·7	47·7	48·8	49·8	50·8
28	33·2	34·2	35·3	36·3	37·3	38·4	39·4	40·4	41·5	42·5	43·6	44·7	45·7	46·7	47·8	48·8	49·9
+30	32·2	33·2	34·3	35·3	36·3	37·4	38·4	39·5	40·5	41·6	42·6	43·7	44·7	45·8	46·8	47·9	48·9

Temperature.	Readings of Alcoholometer.																
	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74
−10° C.	67·1	68·1	69·0	69·9	70·9	71·8	72·7	73·7	74·6	75·5	76·5	77·4	78·3	79·3	80·2	81·1	82·0
8	66·4	67·3	68·3	69·2	70·1	71·1	72·0	73·0	73·9	74·8	75·8	76·7	77·7	78·6	79·5	80·5	81·4
6	65·6	66·5	67·5	68·4	69·4	70·3	71·3	72·2	73·2	74·1	75·1	76·0	77·0	77·9	78·8	79·8	80·7
4	64·8	65·8	66·7	67·7	68·6	69·6	70·5	71·5	72·5	73·4	74·4	75·3	76·3	77·2	78·2	79·1	80·1
− 2	64·1	65·0	66·0	66·9	67·9	68·9	69·8	70·8	71·7	72·7	73·6	74·6	75·6	76·5	77·5	78·4	79·4
0	63·3	64·3	65·2	66·2	67·2	68·1	69·1	70·0	71·0	72·0	72·9	73·9	74·8	75·8	76·8	77·8	78·7

+ 2	62·5	63·5	64·4	65·4	66·4	67·3	68·3	69·3	70·2	71·2	72·2	73·1	74·1	75·1	76·0	77·0	78·0
4	61·6	62·6	63·6	64·6	65·6	66·5	67·5	68·5	69·4	70·4	71·4	72·4	73·4	74·3	75·3	76·3	77·3
6	60·8	61·8	62·8	63·7	64·7	65·7	66·7	67·7	68·6	69·6	70·6	71·6	72·6	73·5	74·5	75·5	76·5
8	59·9	60·9	61·9	62·9	63·9	64·9	65·9	66·9	67·8	68·8	69·8	70·8	71·8	72·7	73·7	74·7	75·7
10	59·1	60·1	61·1	62·1	63·1	64·1	65·1	66·1	67·0	68·0	69·0	70·0	71·0	72·0	72·9	73·9	74·9
12	58·2	59·2	60·2	61·2	62·2	63·2	64·2	65·2	66·2	67·2	68·2	69·2	70·2	71·2	72·2	73·2	74·2
14	57·4	58·4	59·4	60·4	61·4	62·4	63·4	64·4	65·4	66·4	67·4	68·4	69·4	70·4	71·4	72·4	73·4
16	56·5	57·5	58·5	59·5	60·5	61·5	62·5	63·5	64·6	65·6	66·6	67·6	68·6	69·7	70·7	71·7	72·7
18	55·6	56·6	57·6	58·6	59·6	60·6	61·6	62·7	63·7	64·7	65·8	66·8	67·8	68·8	69·8	70·8	71·8
20	54·7	55·7	56·7	57·7	58·7	59·7	60·8	61·8	62·9	63·9	64·9	66·0	67·0	68·0	69·0	70·0	71·0
22	53·8	54·8	55·8	56·8	57·8	58·9	59·9	60·9	62·0	63·0	64·1	65·1	66·1	67·1	68·2	69·2	70·2
24	52·8	53·8	54·9	55·9	56·9	57·9	58·9	59·9	61·0	62·0	63·1	64·1	65·2	66·2	67·2	68·3	69·3
26	51·9	52·9	53·9	54·9	56·0	57·0	58·0	59·1	60·1	61·1	62·2	63·3	64·3	65·4	66·4	67·4	68·5
28	50·9	52·0	53·0	54·0	55·1	56·1	57·1	58·2	59·2	60·3	61·3	62·4	63·4	64·5	65·5	66·6	67·6
+30	49·9	51·0	52·0	53·1	54·1	55·2	56·2	57·3	58·3	59·4	60·4	61·5	62·5	63·6	64·6	65·7	66·7

Temperature.	Readings of Alcoholometer.																
	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	
−10	82·9	83·8	84·8	85·7	86·6	87·5	88·4	89·3	90·2	91·0	91·8	92·7	93·5	94·3	95·2	96·0	
8	82·3	83·2	84·1	85·0	86·0	86·9	87·8	88·7	89·6	90·5	91·3	92·2	93·0	95·9	94·7	95·5	
6	81·6	82·6	83·5	84·4	85·4	86·3	87·2	88·1	89·1	90·0	90·8	91·7	92·5	93·4	94·2	95·1	
4	81·0	81·9	82·9	83·8	84·7	85·7	86·6	87·6	88·5	89·4	90·3	91·2	92·1	92·9	93·8	94·6	
− 2	80·3	81·3	82·2	83·1	84·1	85·0	85·9	86·9	87·8	88·7	89·7	90·6	91·5	92·4	93·3	94·2	
0	79·7	80·6	81·6	82·5	83·5	84·4	85·4	86·3	87·2	88·2	89·1	90·1	91·0	91·9	92·8	93·7	
+ 2	79·0	80·0	80·9	81·9	82·8	83·8	84·7	85·7	86·6	87·5	88·5	89·4	90·4	91·3	92·2	93·1	
4	78·3	79·2	80·2	81·2	82·1	83·1	84·1	85·0	86·0	86·9	87·9	88·8	89·8	90·7	91·6	92·6	
6	77·5	78·4	79·4	80·4	81·4	82·4	83·3	84·3	85·3	86·2	87·2	88·1	89·1	90·0	91·0	92·0	
8	76·7	77·6	78·6	79·6	80·6	81·6	82·5	83·5	84·5	85·5	86·8	87·5	88·4	89·4	90·4	91·4	
10	75·9	76·9	77·9	78·9	79·9	80·9	81·8	82·8	83·8	84·8	85·8	86·8	87·8	88·8	89·8	90·8	
12	75·2	76·2	77·2	78·2	79·2	80·2	81·2	82·2	83·1	84·1	85·1	86·1	87·1	88·1	89·1	90·1	
14	74·4	75·4	76·4	77·4	78·4	79·4	80·4	81·5	82·5	83·5	84·5	85·5	86·5	87·5	88·5	89·5	
16	73·7	74·7	75·7	76·7	77·7	78·7	79·7	80·7	81·7	82·7	83·8	84·8	85·8	86·8	87·9	88·9	
18	72·8	73·8	74·8	75·9	76·9	77·9	78·9	79·9	81·0	82·0	83·0	84·1	85·1	86·1	87·2	88·2	
20	72·1	73·1	74·1	75·1	76·1	76·6	78·2	79·2	80·3	81·3	82·3	83·4	84·4	85·4	86·5	87·6	
22	71·2	72·3	73·3	74·3	75·3	76·2	77·4	78·5	79·5	80·6	81·6	82·7	83·7	84·7	85·8	86·9	
24	70·3	71·4	72·4	73·4	74·5	75·4	76·6	77·6	78·7	79·7	80·8	81·8	82·9	83·9	85·0	86·1	
26	69·5	70·5	71·6	72·6	73·7	74·7	75·8	76·8	77·9	78·9	80·0	81·1	82·2	83·2	84·3	85·4	
28	68·7	69·7	70·7	71·8	72·9	73·9	75·0	76·0	77·1	78·2	79·2	80·3	81·4	82·5	83·6	84·7	
+30	67·8	68·7	69·9	70·9	72·0	73·1	74·1	75·2	76·3	77·3	78·4	79·5	80·6	81·7	82·8	83·9	

TABLE LXXVIb.—**Alcohol; Volume Percentage of Aqueous Solutions at $15\frac{5}{9}°$ C.; 60° F.; $12\frac{4}{9}°$ R.** (Brix.)

Specific Gravity at 60° F.	100 litres of Solution contain		Contraction.	Weight in kgms. of 1 litre Solution.
	Litres of Alcohol.	Litres of Water.		
1·0000	0	100·000	0·000	0·99783
0·9985	1	99·055	0·055	99633
9970	2	98·111	0·111	99484
9956	3	97·176	0·176	99344
9942	4	96·242	0·242	99204
9928	5	95·307	0·307	99065
9915	6	94·382	0·382	98935
9902	7	93·458	0·458	98805
9890	8	92·543	0·543	98685
9878	9	91·629	0·629	98565
9866	10	90·714	0·714	98446
9854	11	89·799	0·799	98326
9843	12	88·895	0·895	98216
9832	13	87·990	0·990	98107
9821	14	87·086	1·086	97997
9811	15	86·191	1·191	97897
9800	16	85·286	1·286	97788
9790	17	84·392	1·392	97688
9780	18	83·497	1·497	97588
9770	19	82·603	1·603	97488
9760	20	81·708	1·708	97388
9750	21	80·813	1·813	97288
9740	22	79·919	1·919	97188
9729	23	79·014	2·014	97078
9719	24	78·119	2·119	96979
9709	25	77·225	2·225	96879
9698	26	76·320	2·320	96767
9688	27	75·426	2·426	96679
9677	28	74·521	2·521	96560
9666	29	73·617	2·617	96449
9655	30	72·712	2·712	96340
9643	31	71·797	2·797	96221
9631	32	70·883	2·883	96101
9618	33	69·958	2·958	95971
9605	34	69·034	3·034	95841
9592	35	68·109	3·109	95712
9579	36	67·184	3·184	95582

TABLE LXXVIB.—*continued.*

Specific Gravity at 60° F.	100 litres of Solution contain		Contraction.	Weight in kgms. of 1 litre Solution.
	Litres of Alcohol.	Litres of Water.		
0·9565	37	66·250	3·250	0·95442
9550	38	65·305	3·305	95292
9535	39	64·361	3·361	95143
9519	40	63·406	3·406	94983
9503	41	62·451	3·451	94823
9487	42	61·497	3·497	94664
9470	43	60·532	3·532	94494
9452	44	59·558	3·558	94315
9435	45	58·593	3·593	94145
9417	46	57·618	3·618	93966
9399	47	56·644	3·644	93786
9381	48	55·669	3·669	93606
9362	49	54·685	3·685	93417
9343	50	53·700	3·700	93227
9323	51	52·705	3·705	93028
9303	52	51·711	3·711	92828
9283	53	50·716	3·716	92628
9263	54	49·722	3·722	92429
9242	55	48·717	3·717	92219
9221	56	47·712	3·712	92020
9200	57	46·708	3·708	91800
9178	58	45·693	3·693	91581
9156	59	44·678	3·678	91361
9134	60	43·664	3·664	91142
9112	61	42·649	3·649	90922
9090	62	41·635	3·635	90703
9067	63	40·610	3·610	90473
9044	64	39·586	3·586	90244
9021	65	38·561	3·561	90014
8997	66	37·526	3·526	89775
8973	67	36·492	3·492	89535
8949	68	35·457	3·457	89296
8925	69	34·423	3·423	89056
8900	70	33·378	3·378	88806
8875	71	32·333	3·333	88557
8850	72	31·289	3·289	88308
8825	73	30·244	3·244	88058

TABLE LXXVIB.—*continued.*

Specific Gravity at 60° F.	100 litres of Solution contain		Contraction.	Weight in kgms. of 1 litre Solution.
	Litres of Alcohol.	Litres of Water.		
0·8799	74	29·190	3·190	0·87799
8773	75	28·135	3·135	87540
8747	76	27·080	3·080	87280
8720	77	26·016	3·016	87011
8693	78	24·951	2·951	86741
8666	79	23·877	2·877	86472
8639	80	22·822	2·822	86202
8611	81	21·747	2·747	85923
8583	82	20·673	2·673	85644
8555	83	19·598	2·598	85364
8526	84	18·514	2·514	85075
8496	85	17·419	2·419	84776
8466	86	16·324	2·324	84476
8436	87	15·230	2·230	84177
8405	88	14·125	2·125	83867
8373	89	13·011	2·011	83548
8339	90	11·876	1·876	83209
8306	91	10·751	1·751	82880
8272	92	9·617	1·617	82540
8237	93	8·472	1·472	82191
8201	94	7·318	1·318	81832
8164	95	6·153	1·153	81463
8125	96	4·968	0·968	81074
8084	97	3·764	0·764	80665
8041	98	2·539	0·539	80235
7995	99	1·285	0·285	79776
7946	100	0·000	0·000	79287

TABLE LXXVIc.—Dilution of Alcohol (by volume).

Desired Strength (by volume).	100 volumes of Alcohol containing by Volume								
	90 per cent.	85 per cent.	80 per cent.	75 per cent.	70 per cent.	65 per cent.	60 per cent.	55 per cent.	50 per cent.
	require to be diluted with the volumes of water given below.								
85	6·56								
80	13·79	6·83							
75	21·89	14·48	7·20						
70	31·05	23·14	15·35	7·64					
65	41·53	33·03	24·66	16·37	8·15				
60	53·65	44·48	35·44	26·47	17·58	8·76			
55	67·87	57·90	48·07	38·32	28·63	19·02	9·47		
50	84·71	73·90	63·04	52·43	41·73	31·25	20·47	10·35	
45	105·34	93·30	81·38	69·54	57·78	46·09	34·46	22·90	11·41
40	130·80	117·34	104·01	90·76	77·58	64·48	51·43	38·46	25·55
35	163·28	148·01	132·88	117·82	102·84	87·93	73·08	58·31	43·59
30	206·22	188·57	171·05	153·61	136·04	118·94	101·71	84·54	67·45
25	266·12	245·15	224·30	203·53	182·83	162·21	141·65	121·16	100·73
20	355·80	329·84	304·01	278·26	252·58	226·98	201·43	175·96	150·55
15	505·27	471·00	436·85	402·81	368·83	334·91	301·07	267·29	233·64
10	804·54	753·65	702·89	652·21	601·60	551·06	500·59	450·19	399·85

TABLE LXXVID.—**Conversion of Kilogrammes of Spirit to Litres according to its strength $15\frac{5}{9}°$ C.** (Fischern.)

Volume Percentage.	1 Kg. = Litres.	Volume Percentage.	1 Kg. = Litres.	Volume Percentage.	1 Kg. = Litres.	Volume Percentage.	1 Kg. = Litres
1	1·003681	**26**	1·033384	**51**	1·074951	**76**	1·145736
2	005191	**27**	034451	**52**	077261	**77**	149284
3	006605	**28**	035627	**53**	079582	**78**	152853
4	008022	**29**	036819	**54**	081913	**79**	156445
5	009414	**30**	037986	**55**	084371	**80**	160060
6	010767	**31**	039278	**56**	086841	**81**	163832
7	012095	**32**	040573	**57**	089322	**82**	167629
8	013322	**33**	041980	**58**	091933	**83**	171450
9	014554	**34**	043390	**59**	094557	**84**	175435
10	015787	**35**	044801	**60**	097193	**85**	179585
11	017024	**36**	046222	**61**	099842	**86**	183765
12	018161	**37**	047753	**62**	102504	**87**	187975
13	019300	**38**	049399	**63**	105301	**88**	192357
14	020142	**39**	051050	**64**	108111	**89**	196914
15	021482	**40**	052817	**65**	110937	**90**	201791
16	022628	**41**	054589	**66**	113902	**91**	206569
17	023673	**42**	056368	**67**	116879	**92**	211528
18	024720	**43**	058264	**68**	119875	**93**	216676
19	025768	**44**	060279	**69**	122886	**94**	222017
20	026820	**45**	062190	**70**	126040	**95**	227555
21	027873	**46**	064220	**71**	129212	**96**	233447
22	028928	**47**	066256	**72**	132402	**97**	239703
23	030091	**48**	068304	**73**	135610	**98**	246332
24	031151	**49**	070472	**74**	138963	**99**	253503
25	032213	**50**	072649	**75**	142341	**100**	261233

TABLE LXXVIe.—Specific Gravity, etc., of Aqueous Alcohol. (Imperial Commission; based on Mendelejeff's results.)

Percent. of Alcohol by Weight.	Specific Gravity $\frac{15°}{15°}$.	Percent. of Alcohol by Weight.	Specific Gravity $\frac{15°}{15°}$.	Percent. of Alcohol by Weight.	Specific Gravity $\frac{15°}{15°}$.
0	1·00000	34	0·95105	68	0·87746
1	0·99812	35	0·94927	69	509
2	630	36	745	70	272
3	453	37	559	71	035
4	284	38	369	72	0·86797
5	120	39	176	73	557
6	0·98964	40	0·93980	74	318
7	813	41	780	75	077
8	668	42	578	76	0·85836
9	528	43	372	77	593
10	394	44	164	78	350
11	263	45	0·92954	79	106
12	136	46	742	80	0·84860
13	012	47	527	81	614
14	0·97890	48	311	82	366
15	769	49	092	83	116
16	649	50	0·91873	84	0·83865
17	530	51	651	85	612
18	410	52	429	86	357
19	289	53	205	87	099
20	167	54	0·90980	88	0·82840
21	043	55	754	89	577
22	0·96916	56	527	90	312
23	786	57	299	91	043
24	653	58	071	92	0·81771
25	517	59	0·89841	93	495
26	377	60	611	94	215
27	233	61	380	95	0·80931
28	085	62	149	96	642
29	0·95932	63	0·88917	97	347
30	775	64	684	98	048
31	614	65	450	99	0·79743
32	449	66	216	100	432
33	279	67	0·87981		

TABLE LXXVIF.—Specific Gravity at 60°F. ($15\frac{5}{9}$°C. or $12\frac{4}{9}$°R.), Volume Percentage and Weight Percentage of Aqueous Alcohol. (Tralles.)

Volume Percentage.	Weight Percentage.	Sp. Gr. $\frac{60°}{60°}$.	Volume Percentage.	Weight Percentage.	Sp. Gr. $\frac{60°}{60°}$.	Volume Percentage.	Weight Percentage.	Sp. Gr. $\frac{60°}{60°}$.
0	0	1·0000	34	28·13	1·9605	68	60·38	0·8949
1	0·80	9985	35	28·99	9592	69	61·44	25
2	1·60	70	36	29·86	79	70	62·50	00
3	2·40	56	37	30·74	65	71	63·58	8875
4	3·20	42	38	31·62	50	72	64·66	50
5	4·00	28	39	32·50	0·9535	73	65·74	25
6	4·81	15	40	33·39	19	74	66·83	8799
7	5·62	02	41	34·28	03	75	67·93	73
8	6·43	9890	42	35·18	9487	76	69·05	47
9	7·24	78	43	36·08	70	77	70·18	20
10	8·05	66	44	36·99	52	78	71·31	8693
11	8·87	54	45	37·90	35	79	72·45	66
12	9·69	43	46	38·82	17	80	73·59	39
13	10·51	32	47	39·74	9399	81	74·74	11
14	11·33	21	48	40·66	81	82	75·91	8583
15	12·15	11	49	41·59	62	83	77·09	55
16	12·98	00	50	42·52	43	84	78·29	26
17	13·80	9790	51	43·47	23	85	79·50	8496
18	14·63	80	52	44·42	03	86	80·71	66
19	15·46	70	53	45·36	9283	87	81·94	36
20	16·28	60	54	46·32	63	88	83·19	05
21	17·11	50	55	47·29	42	89	84·46	8373
22	17·95	40	56	48·26	21	90	85·75	39
23	18·78	29	57	49·23	00	91	87·05	06
24	19·62	19	58	50·21	9178	92	88·37	8272
25	20·46	09	59	51·20	56	93	89·71	37
26	21·30	9698	60	52·20	34	94	91·07	01
27	22·14	88	61	53·20	12	95	92·46	8164
28	22·99	77	62	54·21	9090	96	93·89	25
29	23·84	66	63	55·21	67	97	95·34	8084
30	24·69	55	64	56·22	44	98	96·84	41
31	25·55	43	65	57·24	21	99	98·39	7995
32	26·41	31	66	58·27	8997	100	100·00	46
33	27·27	18	67	59·32	73			

TABLE LXXVIG.—Specific Gravity and Strength of Aqueous Solutions of Alcohol.
(Arranged mostly from Hehner's Results.)

The upper number in each compartment gives the percentage of absolute alcohol by volume, the lower number gives the percentage by weight. Specific Gravities at 60° F. (15$\frac{5}{9}$° C.).

Specific Gravity.	Fourth Place of Decimals in Specific Gravities.									
	9	8	7	6	5	4	3	2	1	0
0·999	0·07 0·05	0·13 0·11	0·20 0·16	0·26 0·21	0·33 0·26	0·40 0·32	0·46 0·37	0·53 0·42	0·60 0·47	0·66 0·53
998	0·73 0·58	0·79 0·63	0·86 0·68	0·93 0·74	0·99 0·79	1·06 0·84	1·13 0·89	1·19 0·95	1·26 1·00	1·34 1·06
997	1·42 1·12	1·49 1·19	1·57 1·25	1·65 1·31	1·73 1·37	1·81 1·44	1·88 1·50	1·96 1·56	2·04 1·62	2·12 1·69
996	2·20 1·75	2·27 1·81	2·35 1·87	2·43 1·94	2·51 2·00	2·58 2·06	2·65 2·11	2·72 2·17	2·79 2·22	2·86 2·28
995	2·93 2·33	3·00 2·39	3·07 2·44	3·14 2·50	3·21 2·56	3·28 2·61	3·35 2·67	3·42 2·72	3·49 2·78	3·55 2·83
994	3·62 2·89	3·69 2·94	3·76 3·00	3·83 3·06	3·90 3·12	3·98 3·18	4·05 3·24	4·12 3·29	4·20 3·35	4·27 3·41
993	4·34 3·47	4·42 3·53	4·49 3·59	4·56 3·65	4·63 3·71	4·71 3·76	4·78 3·82	4·85 3·88	4·93 3·94	5·00 4·00
992	5·08 4·06	5·16 4·12	5·24 4·19	5·32 4·25	5·39 4·31	5·47 4·37	5·55 4·44	5·63 4·50	5·71 4·56	5·78 4·62
991	5·86 4·69	5·94 4·75	6·02 4·81	6·10 4·87	6·17 4·94	6·24 5·00	6·32 5·06	6·40 5·12	6·48 5·19	6·55 5·25
990	6·63 5·31	6·71 5·37	6·78 5·44	6·86 5·50	6·94 5·56	7·01 5·62	7·09 5·69	7·17 5·75	7·25 5·81	7·32 5·87
989	7·40 5·94	7·48 6·00	7·57 6·07	7·66 6·14	7·74 6·21	7·83 6·28	7·92 6·36	8·01 6·43	8·10 6·50	8·18 6·57
988	8·27 6·64	8·36 6·71	8·45 6·78	8·54 6·86	8·63 6·93	8·72 7·00	8·80 7·07	8·88 7·13	8·96 7·20	9·04 7·27
987	9·13 7·33	9·21 7·40	9·29 7·47	9·37 7·53	9·45 7·60	9·54 7·67	9·62 7·73	9·70 7·80	9·78 7·87	9·86 7·93
986	9·95 8·00	10·03 8·07	10·12 8·14	10·21 8·21	10·30 8·29	10·38 8·36	10·47 8·43	10·56 8·50	10·65 8·57	10·73 8·64

TABLE LXXVIG.—*continued.*

Specific Gravity.	Fourth Place of Decimals in Specific Gravities.									
	9	8	7	6	5	4	3	2	1	0
0·985	10·82 8·71	10·91 8·79	11·00 8·86	11·08 8·93	11·17 9·00	11·26 9·07	11·35 9·14	11·44 9·21	11·52 9·29	11·61 9·36
984	11·70 9·43	11·79 9·50	11·87 9·57	11·96 9·64	12·05 9·71	12·13 9·79	12·22 9·86	12·31 9·93	12·40 10·00	12·49 10·08
983	12·58 10·15	12·68 10·23	12·77 10·31	12·87 10·38	12·96 10·46	13·05 10·54	13·15 10·62	13·24 10·69	13·34 10·77	13·43 10·85
982	13·52 10·92	13·62 11·00	13·71 11·08	13·81 11·15	13·90 11·23	13·99 11·31	14·09 11·38	14·18 11·46	14·27 11·54	14·37 11·62
981	14·46 11·69	14·56 11·77	14·65 11·85	14·74 11·92	14·84 12·00	14·93 12·08	15·02 12·15	15·12 12·23	15·21 12·31	15·30 12·38
980	15·40 12·46	15·49 12·54	15·58 12·62	15·68 12·69	15·77 12·77	15·86 12·85	15·96 12·92	16·05 13·00	16·15 13·08	16·24 13·15
979	16·33 13·23	16·43 13·31	16·52 13·38	16·61 13·46	16·70 13·54	16·80 13·62	16·89 13·69	16·98 13·77	17·08 13·85	17·17 13·92
978	17·26 14·00	17·37 14·09	17·48 14·18	17·59 14·27	17·70 14·36	17·81 14·45	17·92 14·55	18·03 14·64	18·14 14·73	18·25 14·82
977	18·36 14·90	18·48 15·00	18·58 15·08	18·68 15·17	18·78 15·25	18·88 15·33	18·98 15·42	19·08 15·50	19·18 15·58	19·28 15·67
976	19·39 15·75	19·49 15·83	19·59 15·92	19·68 16·00	19·78 16·08	19·87 16·15	19·96 16·23	20·06 16·31	20·15 16·38	20·24 16·46
975	20·33 16·54	20·43 16·62	20·52 16·69	20·61 16·77	20·71 16·85	20·80 16·92	20·89 17·00	20·99 17·08	21·09 17·17	21·19 17·25
974	21·29 17·33	21·39 17·42	21·49 17·50	21·59 17·58	21·69 17·67	21·79 17·75	21·89 17·83	21·99 17·92	22·09 18·00	22·18 18·08
973	22·27 18·15	22·36 18·23	22·46 18·31	22·55 18·38	22·64 18·46	22·73 18·54	22·82 18·62	22·92 18·69	23·01 18·77	23·10 18·85
972	23·19 18·92	23·28 19·00	23·38 19·08	23·48 19·17	23·58 19·25	23·68 19·33	23·78 19·42	23·88 19·50	23·98 19·58	24·08 19·67
971	24·18 19·75	24·28 19·83	24·38 19·92	24·48 20·00	24·58 20·08	24·68 20·17	24·78 20·25	24·88 20·33	24·98 20·42	25·07 20·50
970	25·17 20·58	25·27 20·67	25·37 20·75	25·47 20·83	25·57 20·92	25·67 21·00	25·76 21·08	25·86 21·15	25·95 21·23	26·04 21·31

TABLE LXXVIG.—*continued.*

Specific Gravity.	Fourth Place of Decimals in Specific Gravities.									
	9	8	7	6	5	4	3	2	1	0
0·969	26·13 21·38	26·22 21·46	26·31 21·54	26·40 21·62	26·49 21·69	26·58 21·77	26·67 21·85	26·77 21·92	26·86 22·00	26·95 22·08
968	27·04 22·15	27·13 22·23	27·22 22·31	27·31 22·38	27·40 22·46	27·49 22·54	27·59 22·62	27·68 22·69	27·77 22·77	27·86 22·85
967	27·95 22·92	28·04 23·00	28·13 23·08	28·22 23·15	28·31 23·23	28·41 23·31	28·50 23·38	28·59 23·46	28·68 23·54	28·77 23·62
966	28·86 23·69	28·95 23·77	29·04 23·85	29·13 23·92	29·22 24·00	29·31 24·08	29·40 24·15	29·49 24·23	29·58 24·31	29·67 24·38
965	29·76 24·46	29·86 24·54	29·95 24·62	30·04 24·69	30·13 24·77	30·22 24·85	30·31 24·92	30·40 25·00	30·48 25·07	30·57 25·14
964	30·65 25·21	30·73 25·29	30·82 25·36	30·90 25·43	30·98 25·50	31·07 25·57	31·15 25·64	31·23 25·71	31·32 25·79	31·40 25·86
963	31·48 25·93	31·57 26·00	31·65 26·07	31·72 26·13	31·80 26·20	31·88 26·27	31·96 26·33	32·03 26·40	32·11 26·47	32·19 26·53
962	32·27 26·60	32·34 26·67	32·42 26·73	32·50 26·80	32·58 26·87	32·65 26·93	32·73 27·00	32·81 27·07	32·90 27·14	32·98 27·21
961	33·06 27·29	33·15 27·36	33·23 27·43	33·31 27·50	33·39 27·57	33·48 27·64	33·56 27·71	33·64 27·79	33·73 27·86	33·81 27·93
960	33·89 28·00	33·97 28·06	34·04 28·12	34·11 28·19	34·18 28·25	34·25 28·31	34·33 28·37	34·40 28·44	34·47 28·50	34·54 28·56
959	34·61 28·62	34·69 28·69	34·76 28·75	34·83 28·81	34·90 28·87	34·97 28·94	35·05 29·00	35·12 29·07	35·20 29·13	35·28 29·20
958	35·35 29·27	35·43 29·33	35·51 29·40	35·58 29·47	35·66 29·53	35·74 29·60	35·81 29·67	35·89 29·73	35·97 29·80	36·04 29·87
957	36·12 29·93	36·20 30·00	36·26 30·06	36·32 30·11	36·39 30·17	36·45 30·22	36·51 30·28	36·57 30·33	36·64 30·39	36·70 30·44
956	36·76 30·50	36·83 30·56	36·89 30·61	36·95 30·67	37·02 30·72	37·08 30·78	37·14 30·83	37·20 30·89	37·27 30·94	37·34 31·00
955	37·41 31·06	37·48 31·12	37·55 31·19	37·62 31·25	37·69 31·31	37·76 31·37	37·83 31·44	37·90 31·50	37·97 31·56	38·04 31·62
954	38·11 31·69	38·18 31·75	38·25 31·81	38·33 31·87	38·40 31·94	38·47 32·00	38·53 32·06	38·60 32·12	38·68 32·19	38·75 32·25

TABLE LXXVIG.—*continued.*

Specific Gravity.	Fourth Place of Decimals in Specific Gravities.									
	9	8	7	6	5	4	3	2	1	0
0·953	38·82 32·31	38·89 32·37	38·96 32·44	39·04 32·50	39·11 32·56	39·18 32·62	39·25 32·69	39·32 32·75	39·40 32·81	39·47 32·87
952	39·54 32·94	39·61 33·00	39·68 33·06	39·74 33·12	39·81 33·18	39·87 33·24	39·94 33·29	40·01 33·35	40·07 33·41	40·14 33·47
951	40·20 33·53	40·27 33·59	40·34 33·65	40·40 33·71	40·47 33·76	40·53 33·82	40·60 33·88	40·67 33·94	40·74 34·00	40·79 34·05
950	40·84 34·10	40·90 34·14	40·95 34·19	41·00 34·24	41·05 34·29	41·11 34·33	41·16 34·38	41·21 34·43	41·26 34·48	41·32 34·52
949	41·37 34·57	41·42 34·62	41·48 34·67	41·53 34·71	41·58 34·76	41·63 34·81	41·69 34·86	41·74 34·90	41·79 34·95	41·84 35·00
948	41·90 35·05	41·95 35·10	42·01 35·15	42·06 35·20	42·12 35·25	42·17 35·30	42·23 35·35	42·29 35·40	42·34 35·45	42·40 35·50
947	42·45 35·55	42·51 35·60	42·56 35·65	42·62 35·70	42·67 35·75	42·73 35·80	42·78 35·85	42·84 35·90	42·89 35·95	42·95 36·00
946	43·01 36·06	43·07 36·11	43·13 36·17	43·19 36·22	43·26 36·28	43·32 36·33	43·38 36·39	43·44 36·44	43·50 36·50	43·56 36·56
945	43·63 36·61	43·69 36·67	43·75 36·72	43·81 36·78	43·87 36·83	43·93 36·89	44·00 36·94	44·06 37·00	44·12 37·06	44·18 37·11
944	44·24 37·17	44·30 37·22	44·36 37·28	44·43 37·33	44·49 37·39	44·55 37·44	44·61 37·50	44·67 37·56	44·73 37·61	44·79 37·67
943	44·86 37·72	44·92 37·78	44·98 37·83	45·04 37·89	45·10 37·94	45·16 38·00	45·22 38·06	45·28 38·11	45·34 38·17	45·41 38·22
942	45·47 38·28	45·53 38·33	45·59 38·39	45·65 38·44	45·71 38·50	45·77 38·56	45·83 38·61	45·89 38·67	45·95 38·72	46·02 38·78
941	46·08 38·83	46·14 38·89	46·20 38·94	46·26 39·00	46·32 39·05	46·37 39·10	46·42 39·15	46·48 39·20	46·53 39·25	46·59 39·30
940	46·64 39·35	46·70 39·40	46·75 39·45	46·80 39·50	46·86 39·55	46·91 39·60	46·97 39·65	47·02 39·70	47·08 39·75	47·13 39·80
939	47·18 39·85	47·24 39·90	47·29 39·95	47·35 40·00	47·40 40·05	47·45 40·10	47·51 40·15	47·56 40·20	47·62 40·25	47·67 40·30
938	47·72 40·35	47·78 40·40	47·83 40·45	47·89 40·50	47·94 40·55	47·99 40·60	48·05 40·65	48·10 40·70	48·16 40·75	48·21 40·80

TABLE LXXVIG.—*continued.*

Specific Gravity.	Fourth Place of Decimals in Specific Gravities. 9	8	7	6	5	4	3	2	1	0
0·937	48·26 40·85	48·32 40·90	48·37 40·95	48·43 41·00	48·48 41·05	48·54 41·10	48·59 41·15	48·64 41·20	48·70 41·25	48·75 41·30
936	48·80 41·35	48·86 41·40	48·91 41·45	48·97 41·50	49·02 41·55	49·07 41·60	49·13 41·65	49·18 41·70	49·23 41·75	49·29 41·80
935	49·34 41·85	49·40 41·90	49·45 41·95	49·50 42·00	49·55 42·05	49·61 42·10	49·66 42·14	49·71 42·19	49·76 42·24	49·81 42·29
934	49·86 42·33	49·91 42·38	49·96 42·43	50·01 42·48	50·06 42·52	50·11 42·57	50·16 42·62	50·21 42·67	50·26 42·71	50·31 42·76
933	50·37 42·81	50·42 42·86	50·47 42·90	50·52 42·95	50·57 43·00	50·62 43·05	50·67 43·10	50·72 43·14	50·77 43·19	50·82 43·24
932	50·87 43·29	50·92 43·33	50·97 43·39	51·02 43·43	51·07 43·48	51·12 43·52	51·17 43·57	51·22 43·62	51·27 43·67	51·32 43·71
931	51·38 43·76	51·43 43·81	51·48 43·86	51·53 43·90	51·58 43·95	51·63 44·00	51·68 44·05	51·72 44·09	51·77 44·14	51·82 44·18
930	51·87 44·23	51·91 44·27	51·96 44·32	52·01 44·36	52·06 44·41	52·10 44·46	52·15 44·50	52·20 44·55	52·25 44·59	52·29 44·64
929	52·34 44·68	52·39 44·73	52·44 44·77	52·48 44·82	52·53 44·86	52·58 44·91	52·63 44·96	52·68 45·00	52·72 45·05	52·77 45·09
928	52·82 45·14	52·87 45·18	52·92 45·23	52·97 45·28	53·02 45·33	53·06 45·37	53·12 45·42	53·16 45·47	53·21 45·51	53·26 45·56
927	53·31 45·61	53·36 45·66	53·41 45·70	53·46 45·75	53·51 45·80	53·56 45·85	53·61 45·90	53·65 45·94	53·70 45·99	53·75 46·04
926	53·80 46·09	53·85 46·13	53·90 46·18	53·95 46·22	54·00 46·27	54·05 46·31	54·09 46·36	54·14 46·41	54·19 46·45	54·24 46·50
925	54·29 46·54	54·34 46·60	54·38 46·64	54·43 46·69	54·48 46·74	54·53 46·78	54·58 46·83	54·63 40·87	54·67 46·92	54·72 46·96
924	54·77 47·01	54·82 47·06	54·87 47·10	54·92 47·15	54·96 47·19	55·01 47·24	55·06 47·28	55·11 47·33	55·15 47·38	55·20 47·42
923	55·25 47·47	55·30 47·51	55·35 47·55	55·39 47·60	55·44 47·64	55·49 47·69	55·54 47·73	55·58 47·78	55·63 47·82	55·68 47·87
922	55·73 47·91	55·77 47·96	55·82 48·00	55·87 48·05	55·92 48·09	55·96 48·14	56·01 48·18	56·06 48·23	56·10 48·27	56·15 48·32

TABLE LXXVIG.—*continued.*

Specific Gravity.	Fourth Place of Decimals in Specific Gravities.									
	9	8	7	6	5	4	3	2	1	0
0·921	56·20 48·36	56·24 48·41	56·29 48·45	56·34 48·50	56·38 48·54	56·43 48·59	56·48 48·63	56·52 48·68	56·57 48·72	56·62 48·77
920	56·66 48·81	56·71 48·86	56·76 48·90	56·80 48·95	56·85 48·99	56·89 49·04	56·94 49·08	56·99 49·13	57·03 49·17	57·08 49·22
919	57·12 49·26	57·17 49·31	57·22 49·36	57·26 49·40	57·31 49·45	57·36 49·49	57·40 49·54	57·45 49·59	57·49 49·63	57·54 49·68
918	57·59 49·72	57·63 49·76	57·68 49·81	57·73 49·85	57·77 49·89	57·82 49·94	57·86 49·98	57·91 50·03	57·96 50·07	58·00 50·11
917	58·05 50·16	58·10 50·20	58·15 50·24	58·20 50·29	58·24 50·33	58·29 50·38	58·33 50·42	58·38 50·46	58·42 50·51	58·47 50·55
916	58·52 50·59	58·56 50·63	58·61 50·67	58·65 50·72	58·69 50·76	58·74 50·81	58·79 50·85	58·84 50·90	58·88 50·94	58·93 50·98
915	58·97 51·03	59·02 51·07	59·06 51·11	59·11 51·16	59·15 51·20	59·20 51·24	59·24 51·28	59·29 51·33	59·33 51·37	59·38 51·41
914	59·42 51·46	59·47 51·50	59·51 51·54	59·56 51·59	59·60 51·63	59·65 51·68	59·69 51·72	59·74 51·76	59·78 51·81	59·83 51·85
913	59·87 51·89	59·92 51·94	59·96 51·98	60·01 52·03	60·05 52·07	60·10 52·12	60·14 52·16	60·19 52·20	60·23 52·25	60·28 52·29
912	60·32 52·34	60·36 52·38	60·41 52·42	60·46 52·47	60·50 52·51	60·54 52·56	60·59 52·60	60·63 52·64	60·68 52·69	60·72 52·73
911	60·77 52·78	60·81 52·82	60·86 52·86	60·90 52·90	60·95 52·95	60·99 52·99	61·03 53·03	61·08 53·07	61·12 53·11	61·17 53·16
910	61·21 53·20	61·26 53·24	61·30 53·29	61·34 53·33	61·39 53·37	61·43 53·42	61·48 53·46	61·52 53·50	61·56 53·55	61·61 53·59
909	61·65 53·63	61·70 53·68	61·74 53·72	61·78 53·76	61·83 53·81	61·87 53·85	61·92 53·89	61·96 53·93	62·01 53·98	62·05 54·02
908	62·09 54·06	62·14 54·11	62·18 54·15	62·22 54·19	62·27 54·24	62·31 54·28	62·36 54·32	62·40 54·37	62·44 54·41	62·49 54·45
907	62·52 54·49	62·56 54·54	62·61 54·58	62·65 54·62	62·70 54·66	62·74 54·70	62·78 54·75	62·83 54·79	62·87 54·83	62·91 54·87

TABLE LXXVIII.—**Specific Gravities and Corresponding Volume Percentages of Aqueous Alcohol at 60° F., $15\frac{5}{9}$° C., or $12\frac{4}{9}$° R.**

(Imperial Commission's Report based on the results of Mendelejeff's investigations.)

The temperature taken with a mercury thermometer made of Thuringian glass.

Volume Percentage.	Sp. Gr. $\frac{60° F.}{60° F.}$	Volume Percentage.	Sp. Gr. $\frac{60° F.}{60° F.}$	Volume Percentage.	Sp. Gr. $\frac{60° F.}{60° F.}$
0	1·00000				
1	0·99847	36	0·95773	71	0·88762
2	699	37	632	72	511
3	555	38	487	73	257
4	415	39	338	74	000
5	279	40	185	75	87740
6	147	41	029	76	477
7	019	42	94868	77	211
8	98895	43	704	78	86943
9	774	44	536	79	670
10	657	45	364	80	395
11	543	46	188	81	116
12	432	47	008	82	85833
13	324	48	93824	83	547
14	218	49	636	84	256
15	114	50	445	85	84961
16	011	51	250	86	660
17	97909	52	052	87	355
18	808	53	92850	88	044
19	708	54	646	89	83726
20	608	55	439	90	400
21	507	56	229	91	065
22	406	57	015	92	82721
23	304	58	91799	93	365
24	201	59	580	94	81997
25	097	60	358	95	616
26	96991	61	134	96	217
27	883	62	90907	97	80800
28	772	63	678	98	359
29	658	64	447	99	79891
30	541	65	214	100	391
31	421	66	89978		
32	298	67	740		
33	172	68	499		
34	043	69	256		
35	95910	70	010		

TABLE LXXVII.—True Percentage from Observed Percentage of Alcohol. (Imperial Commission.)

Temperature of Spirit. t° C.	Percentage by Weight as found by Observation at t.											
	89	90	91	92	93	94	95	96	97	98	99	100
− 4°	94·8	95·6	96·6	97·4	98·4	99·2						
3	4	4	2	2	0	0	99·8					
2	2	0	0	96·8	97·8	98·8	6					
1	93·8	94·8	95·8	6	6	4	4					
0	6	6	4	4	2	2	2	100				
+ 1	2	2	2	0	0	0	98·8	99·8				
2	0	0	94·8	95·8	96·8	97·6	6	6				
3	92·8	93·6	6	6	4	4	4	2				
4	4	4	2	2	2	2	0	0	100			
5	2	0	0	0	0	96·8	97·8	98·8	99·6			
6	91·8	92·8	93·8	94·6	95·6	6	6	4	4			
7	6	4	4	4	4	4	2	2	2			
8	2	2	2	0	0	0	0	0	98·8	99·8		
9	0	91·8	92·8	93·8	94·8	95·8	96·8	97·6	6	6		
10	90·6	6	6	6	4	4	4	4	4	4		
11	2	2	2	2	2	2	2	2	0	0		
12	0	0	0	0	0	94·8	95·8	96·8	97·8	98·8	99·8	
13	89·6	90·6	91·6	92·6	93·6	6	6	6	6	6	6	
14	4	4	4	4	4	2	2	2	2	2	2	
15	0	0	0	0	0	0	0	0	0	0	0	100
16	88·6	89·6	90·6	91·6	92·8	93·8	94·8	95·8	96·8	97·8	98·8	99·8
17	4	4	4	4	4	4	4	4	4	4	4	4
18	0	0	0	0	0	2	2	2	2	2	2	2
19	87·8	88·8	89·8	90·8	91·8	92·8	93·8	94·8	95·8	96·8	0	0
20	4	4	4	4	4	4	6	6	6	6	97·6	98·6
21	0	0	0	2	2	2	2	2	2	4	4	4
22	86·8	87·8	88·8	89·8	90·8	91·8	0	0	0	0	0	2
23	4	4	4	4	6	6	92·6	93·6	94·8	95·8	96·8	97·8
24	0	0	2	2	2	2	2	4	4	4	4	6
25	85·8	86·8	87·8	88·8	89·8	0	0	0	0	2	2	2
26	4	4	4	4	6	90·6	91·6	92·8	93·8	94·8	0	0
27	0	0	2	2	2	2	4	4	4	6	95·6	96·8
28	84·6	85·8	86·8	87·8	88·8	0	0	0	2	2	4	4
29	4	4	4	4	6	89·6	90·6	91·8	92·8	0	0	2
30	0	0	0	2	2	2	4	4	6	93·6	94·8	95·8

TABLE LXXVIJ.—**Comparison between Volume and Weight Percentages.**

Column I. gives the determinations with Volume alcoholometer at 60° F. on Mercury Thermometer.

Column II. gives the determinations with Weight alcoholometer at 15° C. on Hydrogen Thermometer.

(Imperial Commission.)

I.	II.	I.	II.	I.	II.	I.	II.	I.	II.	I.	II.
0	0·04	17	13·88	34	28·29	51	43·58	68	60·48	85	79·58
1	0·85	18	14·72	35	29·16	52	44·53	69	61·53	86	80·80
2	1·66	19	15·55	36	30·03	53	45·48	70	62·59	87	82·03
3	2·47	20	16·39	37	30·90	54	46·44	71	63·66	88	83·28
4	3·27	21	17·23	38	31·78	55	47·40	72	64·74	89	84·54
5	4·08	22	18·08	39	32·66	56	48·37	73	65·83	90	85·82
6	4·88	23	18·92	40	33·54	57	49·35	74	66·92	91	87·12
7	5·69	24	19·76	41	34·43	58	50·33	75	68·02	92	88·44
8	6·50	25	20·60	42	35·33	59	51·32	76	69·13	93	89·79
9	7·31	26	21·44	43	36·23	60	52·31	77	70·26	94	91·16
10	8·12	27	22·28	44	37·13	61	53·31	78	71·39	95	92·56
11	8·94	28	23·13	45	38·04	62	54·32	79	72·53	96	93·99
12	9·75	29	23·99	46	38·94	63	55·33	80	73·68	97	95·45
13	10·57	30	24·85	47	39·86	64	56·35	81	74·84	98	96·95
14	11·39	31	25·71	48	40·78	65	57·37	82	76·00	99	98·51
15	12·22	32	26·57	49	41·71	66	58·40	83	77·18	100	100·13
16	13·05	33	27·43	50	42·64	67	59·44	84	78·37		

TABLE LXXVIk.—**Conversion of Weights to Volumes.** (Imperial Commission.)

Weight of Spirit in kilogrammes.	Percentage by Weight of Alcohol in the Spirit.														
	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99
	Contains Litres of Pure Absolute Alcohol.														
1	1·1	1·1	1·1	1·1	1·1	1·1	1·1	1·2	1·2	1·2	1·2	1·2	1·2	1·2	1·2
2	2·1	2·2	2·2	2·2	2·2	2·3	2·3	2·3	2·3	2·4	2·4	2·4	2·4	2·5	2·5
3	3·2	3·3	3·3	3·3	3·4	3·4	3·4	3·5	3·5	3·6	3·6	3·6	3·7	3·7	3·7
4	4·3	4·3	4·4	4·4	4·5	4·5	4·6	4·6	4·7	4·7	4·8	4·8	4·9	4·9	5·0
5	5·4	5·4	5·5	5·6	5·6	5·7	5·7	5·8	5·9	5·9	6·0	6·1	6·1	6·2	6·2
6	6·4	6·5	6·6	6·7	6·7	6·8	6·9	7·0	7·0	7·1	7·2	7·3	7·3	7·4	7·5
7	7·5	7·6	7·7	7·8	7·9	8·0	8·0	8·1	8·2	8·3	8·4	8·5	8·6	8·7	8·7
8	8·6	8·7	8·8	8·9	9·0	9·1	9·2	9·3	9·4	9·5	9·6	9·7	9·8	9·9	10·0
9	9·7	9·8	9·9	10·0	10·1	10·2	10·3	10·5	10·6	10·7	10·8	10·9	11·0	11·1	11·2
10	10·7	10·9	11·0	11·1	11·2	11·4	11·5	11·6	11·7	11·9	12·0	12·1	12·2	12·4	12·5
20	21·5	21·7	22·0	22·2	22·5	22·7	23·0	23·2	23·5	23·7	24·0	24·2	24·5	24·7	25·0
30	32·2	32·6	33·0	33·3	33·7	34·1	34·5	34·8	35·2	35·6	36·0	36·4	36·7	37·1	37·5
40	42·9	43·4	43·9	44·4	44·9	45·4	46·0	46·5	47·0	47·5	48·0	48·5	49·0	49·5	50·0
50	53·7	54·3	54·9	55·5	56·2	56·8	57·4	58·1	58·7	59·3	60·0	60·6	61·2	61·9	62·5
60	64·4	65·1	65·9	66·7	67·4	68·2	68·9	69·7	70·4	71·2	72·0	72·7	73·5	74·2	75·0
70	75·1	76·0	76·9	77·8	78·7	79·5	80·4	81·3	82·2	83·1	84·0	84·8	85·7	86·6	87·5
80	85·8	86·9	87·9	88·9	89·9	90·9	91·9	92·9	93·9	94·9	95·9	97·0	98·0	99·0	100·0
90	96·6	97·7	98·9	100·0	101·1	102·3	103·4	104·5	105·7	106·8	107·9	109·1	110·2	111·3	112·5
100	107·3	108·6	109·8	111·1	112·4	113·6	114·9	116·1	117·4	118·7	119·9	121·2	122·5	123·7	125·0

TABLE LXXVII.—Mass and Volume of Absolute Alcohol.

The accepted numbers representing absolute mass and volume must in all cases undergo thorough revision. About 1895 Mendelejeff recalculated the weight of a decimetre cube of water at various temperatures and obtained the following results, which seem to have been rather hastily legalised by the British Authorities.

Temperature.		Weight of Water in Vacuo.	
C.	F.	Dm.^{3} in Grms.	In.^{3} in Grains.
0°	32°	999·716	252·821
4	39·2	999·847	252·854
15	59	998·979	252·635
$16\frac{2}{3}$	62	998·715	252·568
20	68	998·082	252·407

In 1900 the International Congress meeting at Paris accepted as the true mass of a decimetre cube of water at its maximum density the value found by MM. Guillaume and Chappuis, viz.,—

0·9999707 kgm.

The two values differ by a little less than 1 in 8000, or not quite 0·0125 per cent.

In 1899, Messieurs Fabry, de Lepinay and Perot had obtained the value,—

0·9999786 kgm.

Accepting the value sanctioned by the International Conference we get—

Mass of 1 cm.^{3} at 4° C. = 0·9999707 gramme.

Volume of 1 gramme at 4° C. = 1·0000293 cm. cubes.

The accepted values had previously been—

Mass of 1 cm.^{3} at 4° C. = 1·000013 grammes.

Volume of 1 gramme at 4° C. = 0·999987 cm. cube.

To calculate the new standard volumes from the old we have therefore to multiply by

1·0000423

and divide by the same number to get the new standard masses from the old ones.

"Absolute Alcohol," *i.e.* a liquid completely composed of C_2H_5OH and holding practically no gases or other matter in solution, has probably never been prepared in any appreciable quantity.

Fownes gives the specific gravity of absolute alcohol as 0·7938, but it is rather uncertain whether this is to be taken as 15° C./4° C. or 60° F./60° F. Drinkwater found the sp. gr. 60° F./60° F. to be 0·79381.

The following give the specific gravity of "Absolute Alcohol" at 15° C., water at 4° C. being taken as unity.

Dupre and Page, . .	0·7936	
Mendelejeff, . .	0·79367	(1868)
,, . .	0·79363	
Squibb, . . .	0·7935	(1884)
,, . . .	0·7936	(,,)
Young, . . .	0·79369	(1902)
Winkler, 0°/4° C., . .	0·80629	(1905)
Young, 0°/4° . .	0·80626	(1902)

Winkler's details of purification, etc., certainly commend themselves most thoroughly to one's confidence: he seems to have taken almost every conceivable precaution:—his

calculations barely show equal care. Recalculating from Winkler's experimental data the compiler gets the specific gravity of alcohol at 0°/4° = 0·806286. This is very near the value found by Young, and on the whole one feels inclined to accept Winkler's results as practically final. For various reasons Squibb's results can barely be considered as ranking with those of Mendelejeff, Young, and Winkler.

The temperatures at which Winkler worked were 0°, 10°·07, 20°·07 and 30°·07 C., and using his weights, etc., obtained at those temperatures, and Guillaume and Chappuis' value for the maximum density of water, one gets:—

	Wt. of 1 cm.^{3} in grammes.	Volume of 1 grm. in cm. cubes.
At 0°	0·80626248	1·24029088
10 ·07	0·79773641	1·25354689
20 ·07	0·78928400	1·26697108
30 ·07	0·78068465	1·28092694

And $$V_t = V_o(1 + 0{\cdot}00105819737t - 0{\cdot}0_7 5420024t^2 + 0{\cdot}0_7 3649746t^3) \quad . \quad . \quad (A).$$

Mendelejeff gives four values for the sp. gr. of his alcohol 0°/4° C.;—

0·806263	(1)
0·806260	(2)
0·806250	(3)
0·806243	(4)
True mean 0·8062534.	

This corresponds to

Mass of 1 cm.^{3} at 0° C. = 0·80622978 gramme.
Volume of 1 grm. at 0° C. = 1·24034119 cm. cubes.

Mendelejeff gives the sp. gr. of his alcohol ($t°/4°$) as follows:—

At 0° = 0·806243
10 ·38 = 0·797553
19 ·95 = 0·789485
30 ·83 = 0·780247

These give
$$V_t = V_o(1 + 0{\cdot}0010346208 63t + 0{\cdot}0_5 14307957t^2 + 0{\cdot}0_8 2059062t^3) \quad . \quad (B).$$

Winkler gives the following formula—
$$\text{Sp. gr. } t°/4° \text{ C.} = 0{\cdot}80629 - 0{\cdot}0_3 838t - 0{\cdot}0_6 4t^2$$
and this gives
$$V_t = V_o(1 + 0{\cdot}0010393283t + 0{\cdot}0_5 108072t^2 + 0{\cdot}0_8 2253906t^3) \quad . \quad . \quad (C).$$

Taking others of Mendelejeff's determinations we get
$$V_t = V_o(1 + 0{\cdot}0010333245t + 0{\cdot}0_5 1510972t^2 + 0{\cdot}0_9 99486t^3) \quad . \quad . \quad (D).$$

The four equations (A) to (D) are supposed to be appreciable from 0° C. to 30° C.

One series of Mendelejeff's experiments only extend as far as 20°·01 C., and they give
$$V_t = V_o(1 + 0{\cdot}001028418596t + 0{\cdot}0_5 2444016858t^2 - 0{\cdot}0_7 337497963t) \text{ (E); } 0° \text{ to } 20° \text{ C.}$$

Squibb's determinations are only sufficient to calculate two constants, and those only applicable between 0° and 25° C.; thus
$$V_t = V_o(1 + 0{\cdot}00106883t + 0{\cdot}0_6 139569t^2).$$

If we accept Mendelejeff's own value for the density of water at 4° we get,—

Mass of 1 cm.^{3} of Absolute Alcohol at 0° C. = 0·80602442 grm.
Volume of 1 gramme „ „ = 1·24065719 „

In the preceding, and many of the following calculated values, seven or eight places of decimals are given; this has been done simply to avoid introducing errors due to computation alone, but the correctness of any results cannot be relied on beyond ·000001 at the very best; probably five decimals are the utmost that should be depended upon.

Finally, the compiler thinks that Winkler's value, say 0·80626 grm., may be safely accepted as the mass of 1 cm.^{3} of absolute alcohol at 0° C.; Mendelejeff's alcohol had a sp. gr. suspiciously low, and it got lower by keeping apparently. Klason and Norlin have recently obtained results agreeing very closely with Winkler's.

TABLE LXXVIm.—**Mass and Volume of Absolute Alcohol** between 0° and 30° C., calculated from Winkler's Experiments.

t° C.	Vol. at t°. Vol. at 0°=1.	Vol. of 1 grm. in cm. Cubes.	Mass of 1 cm.^{3} in Grms.	t° C.	Vol. at t°. Vol. at 0°=1.	Vol. of 1 grm. in cm. Cubes.	Mass of 1 cm.^{3} in Grms.
0	1·	1·24029088	0·80626248	**16**	1·01706678	1·26145865	0·79273276
1	1·00105818	1·24160333	80541051	**17**	1·01815300	1·26280589	79188707
2	1·00211669	1·24291592	80456013	**18**	1·01924284	1·26415761	79104040
3	1·00317509	1·24422892	80371120	**19**	1·02033652	1·26551408	79019260
4	1·00423426	1·24554259	80286355	**20**	1·02143425	1·26687558	78934349
5	1·00529419	1·24685722	80201701	**21**	1·02253625	1·26824238	78849293
6	1·00635512	1·24817308	80117143	**22**	1·02364273	1·26961475	78764075
7	1·00741724	1·24949042	80032664	**23**	1·02475393	1·27099296	78678679
8	1·00848080	1·25080954	79948248	**24**	1·02587006	1·27237728	78593089
9	1·00954599	1·25213069	79863880	**25**	1·02699133	1·27376799	78507289
10	1·01061305	1·25345415	79779543	**26**	1·02811797	1·27516535	78421262
11	1·01168219	1·25478020	79695222	**27**	1·02925020	1·27656963	78334993
12	1·01275363	1·25610909	79610899	**28**	1·03038823	1·27798112	78248465
13	1·01382759	1·25744112	79526559	**29**	1·03153228	1·27940008	78161663
14	1·01490429	1·25877654	79442186	**30**	1·03268257	1·28082678	78074570
15	1·01598394	1·26011562	79357764				

TABLE LXXVIn.—**Mass and Volume of Absolute Alcohol** between 0° and 30° C., calculated from Mendelejeff's Experiments.

t° C.	Vol. at t°. Vol. at 0°=1.	Vol. of 1 grm. in cm. Cubes.	Mass of 1 cm.^{3} in Grms.	t° C.	Vol. at t°. Vol. at 0°=1.	Vol. of 1 grm. in cm. Cubes.	Mass of 1 cm.^{3} in Grms.
0	1·	1·24034119	0·80622978	**16**	1·01692865	1·26133849	0·79280858
1	1·00103605	1·24162625	80539535	**17**	1·01801217	1·26268243	79196476
2	1·00207498	1·24291487	80456035	**18**	1·01909876	1·26403017	79112035
3	1·00311679	1·24420708	80372475	**19**	1·02018844	1·26538174	79027535
4	1·00416151	1·24550288	80288857	**20**	1·02128121	1·26673715	78942976
5	1·00520913	1·24680229	80205180	**21**	1·02237709	1·26809641	78858358
6	1·00625968	1·24810533	80121445	**22**	1·02347609	1·26945955	78773681
7	1·00731316	1·24941200	80037651	**23**	1·02457822	1·27082657	78688945
8	1·00836959	1·25072234	79953798	**24**	1·02568350	1·27219750	78604150
9	1·00942898	1·25203635	79869886	**25**	1·02679194	1·27357234	78519295
10	1·01049135	1·25335404	79785916	**26**	1·02790355	1·27495111	78434382
11	1·01155670	1·25467544	79701887	**27**	1·02901834	1·27633383	78349410
12	1·01262504	1·25600055	79617799	**28**	1·03013633	1·27772052	78264379
13	1·01369640	1·25732940	79533652	**29**	1·03125752	1·27911118	78179288
14	1·01477078	1·25866199	79449446	**30**	1·03238194	1·28050584	78094138
15	1·01584819	1·25999835	79365182				

TABLE LXXVIo.—**Litres corresponding to Kilogrammes of Absolute Alcohol at 0° C.**

Kgms. Absol. Alcohol.	Litres at 0° C. according to Mendelejeff. As Adopted by English Legislature.	Litres at 0° C. according to Mendelejeff. With G. and Ch.'s Value for Water.	Winkler.	Squibb.	Kgms. of Absol. Alcohol.	Litres according to Mendelejeff. As Adopted by English Legislature.	Litres according to Mendelejeff. With G. and Ch.'s Value for Water.	Winkler.	Squibb.
1	1·240657	1·240341	1·240300	1·240726	51	63·273517	63·257401	63·255314	63·277047
2	2·481314	2·480682	2·480601	2·481453	52	64·514174	64·497742	64·495614	64·517774
3	3·721972	3·721024	3·720901	3·722179	53	65·754831	65·738083	65·735914	65·758500
4	4·962629	4·961365	4·961201	4·962906	54	66·995488	66·978424	66·976215	66·999227
5	6·203286	6·201706	6·201501	6·203632	55	68·236146	68·218765	68·216515	68·239953
6	7·443943	7·442047	7·441802	7·444359	56	69·476803	69·459107	69·456815	69·480679
7	8·684600	8·682388	8·682102	8·685085	57	70·717460	70·699448	70·697115	70·721406
8	9·925258	9·922730	9·922402	9·925811	58	71·958117	71·939789	71·937416	71·962132
9	11·165915	11·163071	11·162702	11·166538	59	73·198774	73·180130	73·177716	73·202859
10	12·406572	12·403412	12·403003	12·407264	60	74·439432	74·420471	74·418016	74·443585
11	13·647229	13·643753	13·643303	13·647991	61	75·680089	75·660813	75·658316	75·684311
12	14·887886	14·884094	14·883603	14·888717	62	76·920746	76·901154	76·898617	76·925038
13	16·128544	16·124435	16·123903	16·129443	63	78·161403	78·141495	78·138917	78·165764
14	17·369201	17·364777	17·364204	17·370170	64	79·402060	79·381836	79·379217	79·406491
15	18·609858	18·605118	18·604504	18·610896	65	80·642718	80·622177	80·619517	80·647217
16	19·850515	19·845459	19·844804	19·851623	66	81·883375	81·862518	81·859818	81·887435
17	21·091172	21·085800	21·085105	21·092349	67	83·124032	83·102860	83·100118	83·128670
18	22·331829	22·326141	22·325405	22·333076	68	84·364689	84·343201	84·340418	84·369396
19	23·572487	23·566483	23·565705	23·573802	69	85·605346	85·583542	85·580719	85·610123
20	24·813144	24·806824	24·806005	24·814528	70	86·846004	86·823883	86·821019	86·850849
21	26·053801	26·047165	26·046306	26·055255	71	88·086661	88·064224	88·061319	88·091576
22	27·294458	27·287506	27·286606	27·295981	72	89·327318	89·304566	89·301619	89·332302
23	28·535115	28·527847	28·526906	28·536708	73	90·567975	90·544907	90·541920	90·573028
24	29·775773	29·768189	29·767206	29·777434	74	91·808632	91·785248	91·782220	91·813755
25	31·016430	31·008530	31·007507	31·018160	75	93·049290	93·025589	93·022520	93·054481
26	32·257087	32·248871	32·247807	32·258887	76	94·289947	94·265930	94·262820	94·295208
27	33·497744	33·489212	33·488107	33·499613	77	95·530604	95·506272	95·503121	95·535934
28	34·738401	34·729553	34·728408	34·740340	78	96·771261	96·746613	96·743421	96·776661
29	35·979059	35·969894	35·968708	35·981066	79	98·011918	97·986954	97·983721	98·017387
30	37·219716	37·210236	37·209008	37·221793	80	99·252576	99·227295	99·224022	99·258113
31	38·460373	38·450577	38·449308	38·462519	81	100·493233	100·467636	100·464322	100·498840
32	39·701030	39·690918	39·689609	39·703245	82	101·733890	101·707977	101·704622	101·739566
33	40·941687	40·931259	40·929909	40·943972	83	102·974547	102·948319	102·944922	102·980293
34	42·182345	42·171600	42·170209	42·184698	84	104·215204	104·188660	104·185223	104·221019
35	43·423002	43·411942	43·410509	43·425425	85	105·455861	105·429001	105·425523	105·461745
36	44·663659	44·652283	44·650810	44·666151	86	106·696519	106·669342	106·665823	106·702472
37	45·904316	45·892624	45·891110	45·906877	87	107·937176	107·909683	107·906123	107·943198
38	47·144973	47·132965	47·131410	47·147604	88	109·177833	109·150025	109·146424	109·183925
39	48·385631	48·373306	48·371710	48·388330	89	110·418490	110·390366	110·386724	110·424651
40	49·626288	49·613648	49·612011	49·629057	90	111·659147	111·630707	111·627024	111·665378
41	50·866945	50·853989	50·852311	50·869783	91	112·899805	112·871048	112·867324	112·906104
42	52·107602	52·094330	52·092611	52·110510	92	114·140462	114·111389	114·107625	114·146830
43	53·348259	53·334671	53·332912	53·351236	93	115·381119	115·351731	115·347925	115·387557
44	54·588917	54·575012	54·573212	54·591962	94	116·621776	116·592072	116·588225	116·628283
45	55·829574	55·815354	55·813512	55·832689	95	117·862433	117·832413	117·828526	117·869010
46	57·070231	57·055695	57·053812	57·073415	96	119·103091	119·072754	119·068826	119·109736
47	58·310888	58·296036	58·294113	58·314142	97	120·343748	120·313095	120·309126	120·350462
48	59·551545	59·536377	59·534413	59·554868	98	121·584405	121·553437	121·549426	121·591189
49	60·792203	60·776718	60·774713	60·795594	99	122·825062	122·793778	122·789727	122·831915
50	62·032860	62·017059	62·015013	62·036321	100	124·065719	124·034119	124·030027	124·072642

If the column headed "Kgms. of Absolute Alcohol" be taken to denote "Weight Percentage of Absolute Alcohol," the other columns will give, in litres, the volume of absolute alcohol obtainable from 100 kgms. of the spirit.

TABLE LXXVIp.—**Volume and Density of Aqueous Alcohol.** * Calculated from Mendelejeff's Values for the Specific Gravity, and Guillaume and Chappuis' Constant.

Percent. of Alcohol by Weight.	0° C. Vol. of 1 grm.	0° C. Mass of 1 cm.³	10° C. Mass of 1 cm.³	20° C. Mass of 1 cm.³	30° C. Mass of 1 cm.
100	1·24034642	0·80622638	0·79785662	0·78942687	0·78093712
95	1·21778066	82116594	81288618	80430643	79550669
90	1·19789811	83479554	82662578	81798603	80915629
85	1·17943283	84786516	83964540	83112565	82229591
80	1·16235172	86032479	85212503	84363528	83480554
75	1·14623107	87242444	86424468	85577493	84716518
70	1·13099898	88417409	87610433	86778457	85922482
65	1·11616642	89592375	88787398	87958423	87122447
60	1·10205781	90739341	89941365	89126389	88301413
55	1·08878724	91845309	91071332	90272355	89453379
50	1·07599451	92937277	92179299	91397322	90574346
45	1·06412133	93974246	93251268	92490290	91707313
40	1·05333878	94936218	94252238	93508260	92784281
35	1·04404629	95781194	95171211	94511231	93810251
30	1·03587042	96537171	95995187	95400205	94748224
25	1·02973722	97112155	96669168	96182182	95625198
20	1·02497725	97563141	97260150	96874162	96410175
15	1·02049013	97992129	97813134	97524142	97139154
10	1·01533033	98490114	98406117	98192123	97889132
5	1·00875503	99132095	99110096	98942101	98677109
0	1·00014932	99985070	99972071	99828075	99576082

TABLE LXXVIq.—**Values of the Constants in the Equation** $W_t = W_0(1 \pm \alpha t \pm \beta t^2 \pm \gamma t^3)$. Calculated from Mendelejeff's Results.

Percent. of Alcohol by Weight.	Value and Sign of α	Value and Sign of β	Value and Sign of γ
100	$-0{\cdot}0_2 10333245$	$-0{\cdot}0_1 00432121$	$+0{\cdot}0_6 00100051$
95	− 09856856	− 02373673	+ 01723503
90	− 09382270	− 04552267	+ 05690608
85	− 09510719	− 01770323	− 00096120
80	− 09370890	− 01454805	− 00868633
75	− 09141442	− 02581620	+ 02965383
70	− 08970805	− 01530299	+ 00288583
65	− 08776742	− 02348161	+ 03262622
60	− 08663803	− 01382867	+ 01387257
55	− 08261782	− 01693057	+ 00100709
50	− 08076719	− 00436515	− 02948656
45	− 07423495	− 02933038	+ 02937578

TABLE LXXVIQ.—*continued.*

Percent. of Alcohol by Weight.	Value and Sign of		
	α	β	γ
40	$-0{\cdot}0_2 06596816$	$-0{\cdot}0_4 07432984$	$+0{\cdot}0_6 14143720$
35	− 06065210	− 03139803	+ 01665889
30	− 03636864	− 11931487	+ 14961015
25	− 04413324	− 00986864	− 04361809
20	− 02652179	− 04569746	+ 00954048
15	− 01206747	− 06386965	+ 02481232
10	− 00043157	− 08740763	+ 07037676
5	+ 00690557	− 09900218	+ 08354878
0	+ 00601739	− 07700924	+ 03833793

From the above we get the points of maximum density for 0 per cent. alcohol abou $+4^{\circ}{\cdot}02$ C., 5 per cent. about $+3^{\circ}{\cdot}74$ C. and 10 per cent. about $-0^{\circ}{\cdot}24$ C.

TABLE LXXVIR.—**Values of the Constants in the Equation.**
$V_t = V_0(1 \pm \alpha t \pm \beta t^2 \pm \gamma t^3)$. Calculated from Mendelejeff's Results.

Percent. of Alcohol by Weight.	Value and Sign of		
	α	β	γ
100	$+0{\cdot}0_2 10333215$	$+0{\cdot}0_4 01510972$	$+0{\cdot}0_6 00099486$
95	+ 09856856	+ 03345249	− 01159797
90	+ 09382270	+ 05432337	− 04753807
85	+ 09510719	+ 02674864	+ 00518889
80	+ 09370890	+ 02333016	+ 01223605
75	+ 09141442	+ 03417279	− 02416997
70	+ 08970805	+ 02335053	+ 00058170
65	+ 08776742	+ 03118473	− 02782830
60	+ 08663803	+ 02133482	− 01082607
55	+ 08261782	+ 02375628	+ 00235117
50	+ 08076719	+ 01088849	+ 03019168
45	+ 07423495	+ 03184120	− 02461200
40	+ 06596816	+ 07868164	− 13133331
35	+ 06065210	+ 03507671	− 01262706
30	+ 03636864	+ 12063855	− 14088337
25	+ 04413324	+ 01181639	+ 04457512
20	+ 02652179	+ 04640087	− 00709787
15	+ 01206747	+ 06401527	− 02326907
10	+ 00043157	+ 08740782	− 07028131
5	− 00690557	+ 09904985	− 08491645
0	− 00601739	+ 07704545	− 03926494

TABLE LXXVIs.—Volume and Density of Aqueous Alcohol.

Calculated from Squibb's Specific Gravities. (G. & Ch.'s Constant.)

Percent. by Weight.	0° C.		4° C.		15° C.		25° C.	
	Mass of 1 cm.^{3}	Vol. of 1 grm.	Mass of 1 cm.^{3}	Vol. of 1 grm.	Mass of 1 cm.^{3}	Vol. of 1 grm.	Mass of 1 cm.^{3}	Vol. of 1 grm.
100	0·805978	1·240726	0·802546	1·246034	0·793237	1·260657	0·784937	1·273988
99	809192	1·235801	805766	1·241054	796427	1·255608	788037	1·268976
98	812094	1·231385	808726	1·236512	799407	1·250928	790867	1·264434
96	818095	1·222351	814646	1·227527	805306	1·241763	796997	1·254710
92	829349	1·205765	825906	1·210792	816556	1·224656	808206	1·237308
88	839799	1·190762	836465	1·195506	827256	1·208816	818836	1·221246
84	850213	1·176175	846785	1·180937	837445	1·194108	829066	1·206177
80	860236	1·162471	856805	1·167127	847475	1·179976	839125	1·191717
76	869998	1·149427	866526	1·154035	857165	1·166637	848895	1·178002
72	879531	1·137196	875974	1·141586	866755	1·153729	858475	1·164856
68	888275	1·125777	885134	1·129772	876284	1·141182	867985	1·152094
64	897905	1·113703	894764	1·117613	885984	1·128688	877834	1·139167
60	907148	1·102355	903984	1·106215	895214	1·117051	887164	1·127187
56	916033	1·091664	912943	1·095358	904244	1·105897	896374	1·115606
52	924845	1·081262	921743	1·084901	913213	1·095034	905463	1·104407
48	933465	1·071276	930423	1·074780	922033	1·084560	914383	1·093633
44	941705	1·061904	938722	1·065277	930533	1·074653	923103	1·083303
40	949364	1·053336	946522	1·056499	938722	1·065278	931653	1·073361

TABLE LXXVIt.—Specific Gravities, etc., of Mixtures of Alcohol and Ether.

Percentage by Weight of Alcohol of 0·809 Specific Gravity.	Specific Gravity.	Percentage by Weight of Alcohol of 0·809 Specific Gravity.	Specific Gravity.
0	0·729	60	0·779
10	·737	70	·786
20	·747	80	·798
30	·756	90	·801
40	·765	100	·809
50	·772		

TABLE LXXVIu.—Specific Gravities, etc., of Aqueous Solutions of Methyl Alcohol at 15°·5. (Ure.)

Percentage of Methyl Alcohol by Weight.	Specific Gravity.	Percentage of Methyl Alcohol by Weight.	Specific Gravity.	Percentage of Methyl Alcohol by Weight.	Specific Gravity.	Percentage of Methyl Alcohol by Weight.	Specific Gravity.
100·00	0·8136	82·00	0·8674	69·44	0·9008	53·70	0·9344
98·00	·8216	80·64	·8712	68·50	·9032	51·84	·9386
96·11	·8256	79·36	·8742	67·56	·9060	50·00	·9414
94·34	·8320	78·13	·8784	66·66	·9070	47·62	·9448
92·22	·8384	77·00	·8820	65·00	·9116	46·00	·9484
90·90	·8418	75·76	·8842	63·30	·9154	43·48	·9518
89·30	·8470	74·63	·8876	61·73	·9184	41·66	·9540
87·72	·8514	73·53	·8918	60·24	·9218	40·00	·9564
86·20	·8564	72·46	·8930	58·82	·9248	38·46	·9584
84·75	·8596	71·43	·8950	57·73	·9266	37·11	·9600
83·33	·8642	70·42	·8981	56·18	·9296	35·71	·9620

TABLE LXXVIv.—Specific Gravities, etc., of Aqueous Solutions of Wood Spirit at 9° C. (H. Deville.)

Percentage of Methyl Alcohol.	Specific Gravity.	Percentage of Methyl Alcohol.	Specific Gravity.
5	0·9857	60	0·9072
10	·9751	70	·8873
20	·9709	80	·8619
30	·9576	90	·8371
40	·9429	100	·8070
50	·9232		

TABLE LXXVIw.—**Specific Gravity and Strength of Aqueous Solutions of Methyl Alcohol.** (Dittmar and Fawsitt.)

Weight of CH_3OH in 100 grms. Solution.	Sp. Gr. $\frac{0^\circ C.}{4^\circ C.}$	Sp. Gr. $\frac{60^\circ F.}{4^\circ C.}$	Weight of CH_3OH in 100 grms. Solution.	Sp. Gr. $\frac{0^\circ C.}{4^\circ C.}$	Sp. Gr. $\frac{60^\circ F.}{4^\circ C.}$	Weight of CH_3OH in 100 grms. Solution.	Sp. Gr. $\frac{0^\circ C.}{4^\circ C.}$	Sp. Gr. $\frac{60^\circ F.}{4^\circ C.}$
0	0·99987	0·99907	34	0·95500	0·94732	68	0·89154	0·87970
1	806	729	35	354	567	69	88922	714
2	631	554	36	204	399	70	687	487
3	462	382	37	051	228	71	470	262
4	299	214	38	94895	055	72	237	021
5	142	048	39	734	93877	73	003	86779
6	98990	98893	40	571	697	74	87767	535
7	843	726	41	400	510	75	530	290
8	701	569	42	239	335	76	290	042
9	563	414	43	076	155	77	049	85793
10	429	262	44	93911	92975	78	86806	542
11	299	111	45	744	793	79	561	290
12	171	97962	46	575	610	80	314	035
13	048	814	47	403	424	81	066	84779
14	97926	668	48	229	237	82	85816	521
15	806	523	49	052	047	83	564	262
16	689	379	50	92873	91855	84	310	001
17	573	235	51	691	661	85	055	83738
18	459	093	52	507	465	86	84798	473
19	346	96950	53	320	267	87	539	207
20	233	808	54	130	066	88	278	82938
21	120	666	55	91938	90863	89	015	668
22	007	524	56	742	657	90	83751	396
23	96894	381	57	544	450	91	485	123
24	780	238	58	343	239	92	218	81849
25	665	093	59	139	026	93	82948	572
26	549	95949	60	90917	89798	94	677	293
27	430	802	61	706	580	95	404	013
28	310	655	62	492	358	96	129	80731
29	187	506	63	276	133	97	81853	448
30	057	355	64	056	88905	98	576	164
31	95921	211	65	89835	676	99	295	79876
32	783	053	66	611	443	100	015	589
33	643	94894	67	384	208			

TABLE LXXVIx.—Squibb's Values for Sp. Gr. of Aqueous Alcohol (On which Table LXXVIs. is based).

Percent. by Weight.	Specific Gravity.			Formula for Volume Expansion (0°-25° C.) calculated by the Compiler.
	4°/4° C.	15°/4° C.	25°/4° C.	$V^t = V_0 \times$.
100	0·80257	0·79326	0·78496	$1 + 0{\cdot}00106883t + 0{\cdot}0_6139569t^2$
99	80579	79645	78806	$1 + 0{\cdot}00106058t + 0{\cdot}0_6527923t^2$
98	80875	79943	79809	$1 + 0{\cdot}00103468t + 0{\cdot}0_51556400t^2$
96	81467	80533	79702	$1 + 0{\cdot}00105849t + 0{\cdot}0_716292t^2$
92	82593	81658	80823	$1 + 0{\cdot}00104163t + 0{\cdot}0_6190598t^2$
88	83649	82728	81886	$1 + 0{\cdot}00099106t + 0{\cdot}0_51319377t^2$
84	84681	83747	82909	$1 + 0{\cdot}00101057t + 0.0_6389790t^2$
80	85683	84750	83915	$1 + 0{\cdot}00100020t + 0{\cdot}0_6246165t^2$
76	86655	85719	84892	$1 + 0{\cdot}00100363t + 0{\cdot}0_6370989t^2$
72	87600	86678	85850	$1 + 0{\cdot}000963455t + 0{\cdot}0_6123365t^2$
68	88516	87631	86801	$1 + 0{\cdot}000877997t + 0{\cdot}0_5228258t^2$
64	89479	88601	87786	$1 + 0{\cdot}000870771t + 0{\cdot}0_5175235t^2$
60	90401	89524	88719	$1 + 0{\cdot}000870343t + 0{\cdot}0_5122725t^2$
56	91297	90427	89640	$1 + 0{\cdot}000840097t + 0{\cdot}0_6148712t^2$
52	92177	91324	90549	$1 + 0{\cdot}000838583t + 0{\cdot}0_6705475t^2$
48	93045	92206	91441	$1 + 0{\cdot}000814454t + 0{\cdot}0_6813120t^2$
44	93875	93056	92313	$1 + 0{\cdot}000792028t + 0.0_6562193t^2$
40	94655	93875	93168	$1 + 0{\cdot}000748691t + 0{\cdot}0_6470181t^2$

TABLE LXXVIy (1).—Specific Gravity, etc., of Solutions of *n* Propyl Alcohol. (Young and Fortey's Determinations.)

Percent. by Weight.	Sp. Gr. 0°/4° C.	Mass of 1 cm.³ at 0° C.	Volume of 1 grm. at 0° C.
94·95	0·83203	0·832006	1·20191496
89·97	84307	843045	1·18617588
84·87	85362	853595	1·17151578
79·96	86360	863575	1·15797742
74·93	87365	873624	1·14465667
71·96	88004	880142	1·13634528

TABLE LXXVIv (2).—**Specific Gravity, etc., of Solution of Tertiary Butyl Alcohol.**
(Young and Fortey's Determinations.)

Percent. by Weight.	Sp. Gr. 20°/4°.	20° C. Mass of 1 cm.^{3}	20° C. Vol. of 1 grm.	Sp. Gr. 25°/4°.	25° C. Mass of 1 cm.^{3}	25° C. Vol. of 1 grm.
100	0·78553	0·785507	1·27306315	0·78056	0·780537	1·28116903
97·36	79128	791257	1·26381218	78653	786507	1·27144457
94·24	79878	798757	1·25194584	79415	794127	1·25924485
90·58	80718	807156	1·23891734	80268	802656	1·24586299
86·00	81820	818176	1·22223087	81364	813616	1·22908080
80·42	83146	831436	1·20273892	82703	827006	1·20918141
73·25	84832	848295	1·17883499	84405	844025	1·18479865

TABLE LXXVIv (3).—**Specfic Gravity, etc., of Solutions of Isobutyl Alcohol.**
(Young and Fortey's Determinations.)

Percent. by Weight.	Sp. Gr. 0°/4° C.	Mass of 1 cm.^{3} at 0° C.	Vol. of 1 grm. at 0° C.
97·72	0·82251	0·822486	1·21582631
95·09	82823	828206	1·20742946
91·79	83492	834896	1·19775464
88·53	84125	841225	1·18874211
86·76	84470	844675	1·18388694
84·81	84829	848265	1·17887668

TABLE LXXVIIA.—Specific Gravities, etc., of Glycerol Solutions.

Percentage of Water.	Sp. Gr. according to Champion and Pellet.	Degrees Baumé according to Berthelot.	Percentage of Water.	Sp. Gr. according to Champion and Pellet.	Degrees Baumé according to Berthelot.
0	1·2640	31·2	11·0	1·2350	28·6
0·5	1·2625	31·0	11·5	1·2335	28·4
1·0	1·2612	30·9	12·0	1·2322	28·3
1·5	1·2600	30·8	12·5	1·2307	28·2
2·0	1·2585	30·7	13·0	1·2295	28·0
2·5	1·2575	30·6	13·5	1·2280	27·8
3·0	1·2560	30·4	14·0	1·2270	27·7
3·5	1·2545	30·3	14·5	1·2255	27·6
4·0	1·2532	30·2	15·0	1·2242	27·4
4·5	1·2520	30·1	15·5	1·2230	27·3
5·0	1·2505	30·0	16·0	1·2217	27·2
5·5	1·2490	29·9	16·5	1·2202	27·0
6·0	1·2480	29·8	17·0	1·2190	26·9
6·5	1·2465	29·7	17·5	1·2177	26·8
7·0	1·2455	29·6	18·0	1·2165	26·7
7·5	1·2440	29·5	18·5	1·2150	26·5
8·0	1·2427	29·3	19·0	1·2137	26·4
8·5	1·2412	29·2	19·5	1·2125	26·3
9·0	1·2400	29·0	20·0	1·2112	26·2
9·5	1·2390	28·9	20·5	1·2100	26·0
10·0	1·2375	28·8	21·0	1·2085	25·9
10·5	1·2362	28·7			

TABLE LXXVIIB.—Specific Gravities, etc., of Glycerol Solutions.

Percentage of Water.	Sp. Gr. at 15° C.		Sp. Gr. at 17°·5 C.	
	Fuchs.	Schweickert.	Fabian.	Matz.
0	1·266	1·267		1·261
5	1·250	1·250		
10	1·233	1·234	1·232	1·232
15	1·217	1·218		
20	1·202	1·203	1·201	1·206
25	1·187	1·188		
30	1·169	1·173	1·179	1·179
35	1·155	1·159		
40	1·144	1·145	1·159	1·153
45	1·130	1·131		
50	1·117	1·118	1·127	1·125
60			1·105	1·099
70			1·075	1·073
80			1·051	1·048
90			1·024	1·024

TABLE LXXVIIc.—Specific Gravities, etc., of Aqueous Solutions of Glycerol.

Percent. of Glycerol.	Percent. of Water.	Weight of Glycerol for each 100 parts water.	Sp. Gr. $\frac{20°}{20°}$ (Nicol.)	Sp. Gr. $\frac{20°}{20°}$ (Gerlach.)	Sp. Gr. $\frac{15°}{15°}$ (Gerlach.)	Sp. Gr. $\frac{12°–14°}{12°}$ (Lenz.)	Sp. Gr. $\frac{17°·5}{17°·5}$ (Strohmer.)	Sp. Gr. $\frac{15°}{15°}$ (Skalweit.)
100	0	∞	1·2635	1·2620	1·2653	1·2691	1·262	1·2650
99	1	9900	2609	2594	2628	2664	259	2625
98	2	4900	2583	2568	2602	2637	257	2600
97	3	3233·3̇	2557	2542	2577	2610	254	2575
96	4	2400	2531	2516	2552	2584	252	2550
95	5	1900	2505	2490	2526	2557	249	2525
94	6	1566·6̇	2479	2464	2501	2531	246	2499
93	7	1328·571	2453	2438	2476	2504	244	2473
92	8	1150	2426	2412	2451	2478	241	2447
91	9	1011·1̇	2399	2386	2425	2451	239	2421
90	10	900	2372	2360	2400	2425	236	2395
89	11	809·0̇9̇	2345	2333	2373	2398	233	2368
88	12	733·3̇	2318	2306	2346	2372	231	2341
87	13	669·231	2291	2279	2319	2345	228	2314
86	14	614·286	2264	2252	2292	2318	226	2287
85	15	566·6̇	2236	2225	2265	2292	223	2260
84	16	525	2209	2198	2238	2265	220	2233
83	17	488·235	2182	2171	2211	2238	218	2206
82	18	455·5̇	2155	2144	2184	2212	215	2179
81	19	426·316	2128	2117	2157	2185	213	2152
80	20	400	2101	2090	2130	2159	210	2125
79	21	376·190	2074	2063	2102	2122	207	2098
78	22	354·5̇4̇	2047	2036	2074	2106	204	2071
77	23	334·782	2020	2009	2046	2079	202	2044
76	24	316·6̇	1992	1982	2018	2042	199	2017
75	25	300	1965	1955	1990	2016	196	1990
74	26	284·615	1938	1928	1962	1999	193	1963
73	27	270·370	1911	1901	1934	1973	190	1936
72	28	257·143	1884	1874	1906	1945	188	1909
71	29	244·828	1856	1847	1878	1918	185	1882
70	30	233·3̇	1829	1820	1850	1889	182	1855
69	31	222·580	1802	1793	1822	1858	179	1827
68	32	212·5	1775	1766	1794	1826	176	1799
67	33	203·0̇3̇	1747	1739	1766	1795	173	1771
66	34	194·118	1720	1712	1738	1764	170	1743
65	35	185·714	1693	1685	1710	1733	167	1715
64	36	167·7̇	1665	1658	1682	1702	163	1686

TABLE LXXVIIc.—*continued.*

Percent. of Glycerol.	Percent. of Water.	Weight of Glycerol for each 100 parts water.	Sp. Gr. $\frac{20°}{20°}$ (Nicol.)	Sp. Gr. $\frac{20°}{20°}$ (Gerlach.)	Sp. Gr. $\frac{15°}{15°}$ (Gerlach.)	Sp. Gr. $\frac{12°-14°}{12°}$ (Lenz.)	Sp. Gr. $\frac{17°·5}{17°·5}$ (Strohmer.)	Sp. Gr. $\frac{15°}{15°}$ (Skalweit.)
63	37	170·270	1·1638	1·1631	1·1654	1·1671	1·160	1·1657
62	38	163·158	1611	1604	1626	1640	157	1628
61	39	156·410	1583	1577	1598	1610	154	1599
60	40	150	1556	1550	1570	1582	151	1570
59	41	143·902	1529	1523	1542	1556	149	1542
58	42	138·095	1502	1496	1514	1530	146	1514
57	43	132·558	1474	1469	1486	1505	144	1486
56	44	127·27	1447	1412	1458	1480	142	1458
55	45	122·2	1420	1415	1430	1455	140	1430
54	46	117·391	1392	1388	1402	1430	137	1402
53	47	112·766	1365	1361	1374	1403	135	1374
52	48	108·3	1338	1334	1346	1375	133	1346
51	49	104·082	1310	1307	1318	1348	130	1318
50	50	100	1283	1280	1290	1320	128	1290
49	51	96·078	1256	1253	1263	1293		1263
48	52	92·308	1228	1226	1236	1265		1236
47	53	88·679	1201	1199	1209	1238		1209
46	54	85·185	1174	1172	1182	1210		1182
45	55	81·81	1147	1145	1155	1183		1155
44	56	78·571	1120	1118	1128	1155		1128
43	57	75·439	1093	1091	1101	1127		1101
42	58	72·414	1066	1064	1074	1100		1074
41	59	69·492	1039	1037	1047	1072		1047
40	60	66·6	1012	1010	1020	1045		1020
39	61	63·934				1017		0993
38	62	61·290				0989		0966
37	63	58·730				0962		0939
36	64	56·25				0934		0912
35	65	53·846	0879	0875	0885	0907		0885
34	66	51·51				0880		0858
33	67	49·254				0852		0831
32	68	47·059				0825		0804
31	69	44·928				0798		0777
30	70	42·857	0747	0740	0750	0771		0750
29	71	40·845				0744		0724
28	72	38·8				0716		0698
27	73	36·986				0689		0672

TABLE LXXVIIc.—*continued.*

Percent. of Glycerol.	Percent. of Water.	Weight of Glycerol for each 100 parts water.	Sp. Gr. $\frac{20°}{20°}$ (Nicol.)	Sp. Gr. $\frac{20°}{20°}$ (Gerlach.)	Sp. Gr. $\frac{15°}{15°}$ (Gerlach.)	Sp. Gr. $\frac{12°–14°}{12°}$ (Lenz.)	Sp. Gr. $\frac{17°·5}{17°·5}$ (Strohmer.)	Sp. Gr. $\frac{15°}{15°}$ (Skalweit.)
26	74	35·135				1·0663		1·0646
25	75	33·3	1·0617	1·0610	1·0620	0635		0620
24	76	31·579				0608		0594
23	77	29·887				0580		0568
22	78	28·205				0553		0542
21	79	26·582				0525		0516
20	80	25	0488	0480	0490	0498		0490
19	81	23·457				0471		0465
18	82	21·951				0446		0440
17	83	20·482				0422		0415
16	84	19·046				0398		0390
15	85	17·647	0362	0357	0367	0374		0365
14	86	16·279				0349		0340
13	87	14·943				0322		0315
12	88	13·63				0297		0290
11	89	12·360				0271		0265
10	90	11·1	0239	0235	0245	0245		0240
9	91	9·882				0221		0216
8	92	8·696				0196		0192
7	93	7·527				0172		0168
6	94	6·383				0147		0144
5	95	5·263	0118	0117	0122	0123		0120
4	96	4·16				0098		0096
3	97	3·093				0074		0072
2	98	2·041				0049		0048
1	99	1·10				0025		0024

TABLE LXXVIIID.—Refractive Powers of Aqueous Solutions of Glycerol.

Percent. of Glycerol.	Refractive Index for D line 12°·5–12°·8 n(D). (Lenz.)	Difference between n(D) for Pure Water and n(D) for Glycerol Solution. (Lenz.)	Refractive Index for D line 17°·5 n(D). (Strohmer.)	Difference between n(D) for Pure Water and n(D) for Glycerol Solution. (Strohmer.)	Refractive Index for D line 15° n(D). (Skalweit.)	Percent. of Glycerol.	Refractive Index for D line 12°·5–12°·8 n(D). (Lenz.)	Difference between n(D) for Pure Water and n(D) for Glycerol Solution. (Lenz.)	Refractive Index for D line 17°·5 n(D). (Strohmer.)	Difference between n(D) for Pure Water and n(D) for Glycerol Solution. (Strohmer.)	Refractive Index for D line 15° n(D). (Skalweit.)
100	1·4758	0·1424	1·4727	0·1396	1·4742	49	1·3993	0·0659			1·3981
99	4744	1410	4710	1379	4728	48	3979	0645			3966
98	4729	1395	4698	1367	4712	47	3964	0630			3952
97	4715	1381	4681	1350	4698	46	3950	0616			3938
96	4700	1366	4670	1339	4684	45	3935	0601			3924
95	4686	1352	4653	1322	4670	44	3921	0587			3910
94	4671	1337	4636	1305	4655	43	3906	0572			3896
93	4657	1323	4625	1294	4640	42	3890	0556			3882
92	4642	1308	4608	1277	4625	41	3875	0541			3868
91	4628	1294	4596	1265	4610	40	3860	0526			3854
90	4613	1279	4579	1247	4595	39	3844	0510			3840
89	4598	1264	4563	1232	4580	38	3829	0495			3827
88	4584	1250	4551	1220	4565	37	3813	0479			3813
87	4569	1235	4534	1203	4550	36	3798	0464			3799
86	4555	1221	4523	1192	4535	35	3785	0451			3785
85	4540	1206	4506	1175	4520	34	3772	0438			3771
84	4525	1191	4489	1158	4505	33	3758	0424			3757
83	4511	1177	4478	1147	4490	32	3745	0411			3743
82	4496	1162	4461	1130	4475	31	3732	0398			3729
81	4482	1148	4449	1118	4460	30	3719	0385			3715
80	4467	1133	4432	1101	4444	29	3706	0372			3701
79	4453	1119	4415	1084	4429	28	3692	0358			3687
78	4438	1104	4398	1067	4414	27	3679	0345			3674
77	4424	1090	4387	1056	4399	26	3666	0332			3660
76	4409	1075	4370	1039	4384	25	3652	0318			3647
75	4395	1061	4353	1022	4369	24	3639	0305			3633
74	4380	1046	4336	1005	4354	23	3626	0292			3620
73	4366	1032	4319	0988	4339	22	3612	0278			3607
72	4352	1018	4308	0977	4324	21	3599	0265			3594
71	4337	1003	4291	0960	4309	20	3585	0251			3581
70	4321	0987	4274	0943	4295	19	3572	0238			3568
69	4304	0970	4257	0926	4280	18	3559	0225			3555
68	4286	0952	4240	0909	4265	17	3546	0212			3542
67	4267	0933	4223	0892	4250	16	3533	0199			3529
66	4249	0915	4206	0875	4235	15	3520	0186			3516
65	4231	0897	4189	0858	4220	14	3507	0173			3503
64	4213	0879	4167	0836	4205	13	3494	0160			3490
63	4195	0861	4150	0819	4190	12	3480	0146			3477
62	4176	0842	4133	0802	4175	11	3467	0133			3464
61	4158	0824	4116	0785	4160	10	3454	0120			3452
60	4140	0806	4099	0768	4144	9	3442	0108			3439
59	4126	0792	4087	0756	4129	8	3430	0096			3426
58	4114	0780	4070	0739	4114	7	3417	0083			3414
57	4102	0768	4059	0728	4099	6	3405	0071			3402
56	4091	0757	4048	0717	4084	5	3392	0058			3390
55	4079	0745	4036	0705	4069	4	3380	0046			3378
54	4065	0731	4019	0688	4054	3	3367	0033			3366
53	4051	0717	4008	0677	4039	2	3355	0021			3354
52	4036	0702	3997	0666	4024	1	3342	0008			3342
51	4022	0688	3980	0649	4010	0		0000			3330
50	4007	0673	3969	0638	3996						

TABLE LXXVIIIA.—Specific Gravities of Solutions of Cane Sugar.

Percentages of Sugar.	Specific Gravity according to					Percentages of Sugar.	Specific Gravity according to				
	Balling, 17°·5.	Brix, 17°·5.	Gerlach, 17°·5.	Niemann, 17°·5.	Scheibler, 15°.		Balling, 17°·5.	Brix, 17°·5.	Gerlach, 17°·5.	Niemann, 17°·5.	Scheibler, 15°.
0	1·0000	1·00000	1·00000	1·0000	1·00000	38	1·1692	1·16920	1·16912	1·1681	1·16960
1	0040	00388	00388	0035	00390	39	1743	17430	17422	1731	17470
2	0080	00779	00779	0070	00783	40	1794	17943	17936	1781	17985
3	0120	01173	01173	0106	01178	41	1846	18460	18453	1832	18503
4	0160	01570	01569	0143	01576	42	1898	18981	18974	1883	19024
5	0200	01970	01969	0179	01978	43	1951	19505	19499	1935	19550
6	0240	02373	02371	0215	02382	44	2004	20033	20027	1989	20079
7	0281	02779	02777	0254	02789	45	2057	20565	20559	2043	20611
8	0322	03187	03185	0291	03199	46	2111	21100	21095	2098	21147
9	0363	03599	03596	0328	03611	47	2165	21639	21634	2153	21687
10	0404	04014	04010	0367	04027	48	2219	22182	22177	2209	22232
11	0446	04431	04428	0410	04446	49	2274	22728	22724	2265	22779
12	0488	04852	04848	0456	04868	50	2329	23278	23275	2322	23330
13	0530	05276	05272	0504	05293	51	2385	23832	23829	2378	23885
14	0572	05703	05698	0552	05721	52	2441	24390	24388	2434	24444
15	0614	06133	06128	0600	06152	53	2479	24951	24950	2490	25007
16	0657	06566	06561	0647	06586	54	2553	25517	25516	2546	25574
17	0700	07002	06997	0693	07023	55	2610	26086	26086	2602	26144
18	0744	07441	07436	0738	07464	56	2667	26658	26660	2658	26718
19	0788	07884	07878	0784	07907	57	2725	27235	27238	2714	27297
20	0832	08329	08323	0832	08354	58	2783	27816	27820	2770	27879
21	0877	08778	08772	0877	08804	59	2841	28400	28405	2826	28465
22	0922	09231	09224	0922	09257	60	2900	28989	28995	2882	29056
23	0967	09686	09679	0967	09713	61	2959	29581	29589	2938	29650
24	1013	10145	10138	1010	10173	62	3019	30177	30187	2994	30248
25	1059	10607	10600	1056	10635	63	3079	30777	30789	3050	30850
26	1106	11072	11065	1103	11101	64	3139	31381	31395	3105	31457
27	1153	11541	11533	1150	11571	65	3190	31989	32005	3160	32067
28	1200	12013	12005	1197	12044	66	3260	32601	32619	3215	32682
29	1247	12488	12480	1245	12520	67	3321	33217	33237	3270	33301
30	1295	12967	12959	1293	12999	68	3383	33836	33859	3324	33923
31	1343	13449	13441	1340	13482	69	3445	34460	34486	3377	34550
32	1391	13934	13926	1388	13969	70	3507	35088	35117	3430	35182
33	1440	14423	14415	1436	14458	71	3570	35720	35752	3483	35817
34	1490	14915	14907	1484	14952	72	3633	36355	36391	3535	36457
35	1540	15411	15403	1533	15448	73	3696	36995	37035	3587	37101
36	1590	15911	15903	1582	15949	74	3760	37639	37682	3658	37749
37	1641	16413	16406	1631	16452	75		38288	38334		38401

TABLE LXXVIIIB.—*continued.*

1	2·572	2·829	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0·02572
2	5·144	5·402	5·659	5·916	6·173	6·430	6·688	6·945	7·202	7·459	
3	7·717	7·974	8·231	8·488	8·745	9·003	9·260	9·517	9·774	10·032	
4	10·289	10·546	10·803	11·060	11·318	11·575	11·832	12·089	12·346	12·604	
5	12·861	13·118	13·375	13·633	13·890	14·147	14·404	14·661	14·919	15·176	
6	15·433	15·690	15·948	16·205	16·462	16·719	16·976	17·234	17·491	17·748	
7	18·005	18·262	18·520	18·777	19·034	19·291	19·549	19·806	20·063	20·320	
8	20·577	20·835	21·092	21·349	21·606	21·863	22·121	22·378	22·635	22·892	
9	23·150	23·407	23·664	23·921	24·179	24·436	24·693	24·950	25·207	25·465	
1·010	25·722	25·980	26·238	26·496	26·754	27·011	27·269	27·527	27·785	28·043	0·02579
11	28·301	28·559	28·817	29·075	29·333	29·591	29·849	30·107	30·365	30·623	
12	30·880	31·138	31·396	31·654	31·912	32·170	32·428	32·686	32·944	33·202	
13	33·460	33·718	33·976	34·234	34·492	34·749	35·007	35·265	35·523	35·781	
14	36·039	36·297	36·555	36·813	37·071	37·329	37·587	37·845	38·103	38·361	
15	38·618	38·876	39·134	39·392	39·650	39·908	40·167	40·424	40·682	40·940	
16	41·198	41·456	41·714	41·872	42·230	42·487	42·745	43·003	43·261	43·518	
17	43·777	44·035	44·293	44·551	44·809	45·067	45·325	45·583	45·841	46·099	
18	46·356	46·614	46·872	47·130	47·388	47·646	47·904	48·162	48·420	48·678	
19	48·936	49·194	49·452	49·710	49·968	50·225	50·483	50·741	50·999	51·257	
1·020	51·515	51·773	52·032	52·290	52·548	52·807	53·065	53·323	53·582	53·840	0·02583
21	54·098	54·357	54·615	54·873	55·132	55·390	55·648	55·907	56·165	56·423	
22	56·682	56·940	57·198	57·456	57·715	57·973	58·231	58·490	58·748	59·006	
23	59·265	59·523	59·781	60·040	60·298	60·556	60·815	61·073	61·331	61·590	
24	61·848	62·106	62·365	62·623	62·881	63·140	63·398	63·656	63·914	64·173	
25	64·431	64·689	64·948	65·206	65·464	65·723	65·981	66·239	66·498	66·756	
26	67·014	67·273	67·531	67·789	68·048	68·306	68·564	68·823	69·081	69·339	

27	69·598	69·856	70·114	70·372	70·631	70·889	71·147	71·406	71·664	71·922	0·02583.
28	72·181	72·439	72·697	72·956	73·214	73·472	73·731	73·989	74·247	74·506	
29	74·764	75·022	75·281	75·539	75·797	76·056	76·314	76·572	76·830	77·089	
1·030	77·347	77·606	77·865	78·124	78·383	78·642	78·901	79·160	79·419	79·678	0·02589
31	79·937	80·196	80·455	80·714	80·972	81·231	81·490	81·749	82·008	82·267	
32	82·526	82·785	83·044	83·303	83·562	83·821	84·080	84·339	84·598	84·857	
33	85·116	85·375	85·634	85·893	86·151	86·410	86·669	86·928	87·187	87·446	
34	87·705	87·964	88·223	88·482	88·741	89·000	89·259	89·518	89·777	90·036	
35	90·295	90·554	90·813	91·072	91·331	91·589	91·848	92·107	92·366	92·625	
36	92·884	93·143	93·402	93·661	93·920	94·179	94·438	94·697	94·956	95·215	
37	95·474	95·733	95·992	96·251	96·510	96·769	97·027	97·286	97·545	97·804	
38	98·063	98·322	98·581	98·840	99·099	99·358	99·617	99·876	100·135	100·394	
39	100·653	100·912	101·171	101·430	101·689	101·948	102·206	102·465	102·724	102·983	
1·040	103·242	103·501	103·761	104·020	104·279	104·538	104·797	105·057	105·316	105·575	0·02591
41	105·834	106·093	106·353	106·612	106·871	107·130	107·389	107·648	107·908	108·167	
42	108·426	108·685	108·944	109·204	109·463	109·722	109·981	110·240	110·500	110·759	
43	111·018	111·277	111·536	111·796	112·055	112·314	112·573	112·832	113·091	113·351	
44	113·610	113·869	114·128	114·387	114·647	114·906	115·165	115·424	115·683	115·943	
45	116·202	116·461	116·720	116·979	117·238	117·498	117·757	118·016	118·275	118·534	
46	118·794	119·053	119·312	119·571	119·830	120·090	120·349	120·608	120·867	121·126	
47	121·385	121·645	121·904	122·163	122·422	122·681	122·941	123·200	123·459	123·718	
48	123·977	124·237	124·496	124·755	125·014	125·273	125·532	125·792	126·051	126·310	
49	126·569	126·828	127·088	127·437	127·606	127·865	128·124	128·384	128·643	128·902	
1·050	129·161	129·421	129·681	129·941	130·200	130·460	130·720	130·980	131·240	131·500	0·02598
51	131·759	132·019	132·279	132·539	132·799	133·058	133·318	133·578	133·838	134·098	
52	334·358	134·617	134·817	135·137	135·397	135·657	135·917	136·176	136·436	136·696	
53	136·956	137·216	137·475	137·735	137·995	138·255	138·515	138·775	139·034	139·294	
54	139·554	139·814	140·074	140·334	140·593	140·853	141·113	141·373	141·633	141·892	
55	142·152	142·412	142·672	142·932	143·192	143·451	143·711	143·971	144·231	144·491	
56	144·751	145·010	145·270	145·530	145·790	146·050	146·309	146·569	146·829	147·089	
57	147·349	147·609	147·868	148·128	148·388	148·648	148·908	149·167	149·427	149·687	
58	149·947	150·207	150·467	150·726	150·986	151·246	151·506	151·766	152·026	152·285	
59	152·545	152·805	153·065	153·325	153·585	153·844	154·104	154·364	154·624	154·884	

TABLE LXXVIIIB.—*continued.*

Specific Gravity.	Fourth Decimal place in Specific Gravity.										Increase in weight of Sugar for each 0·00001 increase in Specific Gravity.
	0	1	2	3	4	5	6	7	8	9	
1·060	155·144	155·404	155·664	155·925	156·185	156·446	156·706	156·967	157·227	157·488	
61	157·748	158·009	158·269	158·529	158·790	159·050	159·311	159·571	159·832	160·092	
62	160·352	160·613	160·874	161·134	161·395	161·655	161·915	162·176	162·436	162·497	
63	162·957	163·218	163·478	163·739	163·999	164·260	164·520	164·780	165·041	165·301	
64	165·562	165·822	166·083	166·343	166·604	166·864	167·125	167·385	167·646	167·906	0·02605
65	168·166	168·427	168·687	168·948	169·208	169·469	169·729	169·990	170·250	170·511	
66	170·771	171·032	171·292	171·552	171·813	172·073	172·334	172·594	172·855	173·115	
67	173·376	173·636	173·897	174·157	174·417	174·678	174·938	175·199	175·459	175·720	
68	175·980	176·241	176·501	176·762	177·022	177·283	177·543	177·803	178·064	178·324	
69	178·585	178·845	179·106	179·366	179·627	179·887	180·148	180·408	180·669	180·929	
1·070	181·189	181·450	181·711	181·972	182·233	182·494	182·755	183·016	183·277	183·538	
71	183·799	184·060	184·321	184·582	184·843	185·104	185·365	185·625	185·886	186·147	
72	186·408	186·669	186·930	187·191	187·452	187·713	187·974	188·235	188·496	188·757	
73	189·018	189·279	189·540	189·801	190·061	190·322	190·583	190·844	191·105	191·366	
74	191·627	191·888	192·149	102·410	192·671	192·932	193·193	193·454	193·715	193·976	
75	194·237	194·498	194·758	195·019	195·280	195·541	195·802	196·063	196·324	196·585	0·02609
76	196·846	197·107	197·368	197·629	197·890	198·151	198·412	198·673	198·934	199·194	
77	199·455	199·716	199·977	200·238	200·499	200·760	201·021	201·282	201·543	201·804	
78	202·065	202·326	202·587	202·848	203·109	203·370	203·631	203·891	204·152	204·413	
79	204·674	204 935	205·196	205·457	205·718	205·979	206·240	206·501	206·762	207·023	
1·080	207·284										

This table is only applicable to solutions of pure cane sugar at 15° C., and, for all practical purposes, the number of grammes per litre divided by 16 will give in pounds avoirdupois the weight of sugar per cubic foot; or, divided by 100, they give weight of sugar per gallon of solution.

TABLE LXXVIIIc.—**Sugar Contents of boiled Extracts of Grains, Syrups, etc.** (Maumene.)

Weight per Litre.	Syrup D=1·400.	Crystallised Sugar.	Total Sugar.	Percentage of Sugar.	Weight per Litre.	Syrup D=1·400.	Crystallised Sugar.	Total Sugar.	Percentage of Sugar.
1405	1334·75	70·25	1090·378	77·606	1505	677·25	827·75	1345·335	89·390
1410	1304·325	105·675	1102·562	78·197	1510	641·825	868·175	1357·571	89·885
1415	1273·50	141·50	1114·812	78·783	1515	606	909	1372·155	90·572
1420	1242·415	177·585	1127·155	79·376	1520	569·915	950·085	1385·651	91·162
1425	1211·25	213·75	1139·480	79·964	1525	533·75	991·25	1399·232	91·753
1430	1179·825	250·175	1151·885	80·549	1530	497·325	1032·675	1412·756	92·337
1435	1148	287	1164·390	81·142	1535	460·50	1074·50	1426·454	92·927
1440	1115·915	324·085	1176·955	81·735	1540	423·415	1116·585	1440·182	93·519
1445	1083·75	361·25	1189·540	82·320	1545	386·25	1153·75	1453·917	94·103
1450	1051·325	398·675	1202·177	82·907	1550	348·825	1201·175	1467·959	94·696
1455	1018·50	436·50	1214·975	83·504	1555	311	1244	1481·692	95·286
1460	985·415	474·585	1227·705	84·091	1560	272·915	1287·085	1495·658	95·876
1465	952·25	512·75	1240·216	84·676	1565	234·75	1330·25	1509·632	96·463
1470	918·825	551·175	1253·402	85·264	1570	196·325	1373·675	1523·706	97·050
1475	885	590	1266·391	85·857	1575	157·50	1417·50	1537·873	97·643
1480	850·915	629·085	1279·431	86·449	1580	118·415	1461·585	1552·077	98·232
1485	816·75	668·25	1292·447	87·032	1585	79·25	1505·75	1566·319	98·822
1490	782·325	707·675	1305·569	87·622	1590	39·825	1550·175	1580·609	99·409
1495	747·50	747·50	1328·862	88·217	1595	0	1595	1595	100
1500	712·415	787·585	1332·055	88·804					

TABLE LXXVIIId.—**Starch in Potatoes.**

Sp. Gr. of Potatoes.	Percentage of Dry Matter.	Percentage of Starch.	Sp. Gr. of Potatoes.	Percentage of Dry Matter.	Percentage of Starch.	Sp. Gr. of Potatoes.	Percentage of Dry Matter.	Percentage of Starch.
1·080	19·7	13·9	1·108	25·7	19·9	1·136	31·7	25·9
082	20·1	14·3	110	26·1	20·3	138	32·1	26·3
084	20·5	14·7	112	26·5	20·7	140	32·5	26·7
086	20·9	15·1	114	26·9	21·1	142	33·0	27·2
088	21·4	15·6	116	27·4	21·6	144	33·4	27·6
090	21·8	16·0	118	27·8	22·2	146	33·8	28·0
092	22·2	16·4	120	28·3	22·5	148	34·3	28·5
094	22·7	16·9	122	28·7	22·9	150	34·7	28·9
096	23·1	17·3	124	29·1	23·3	152	35·1	29·3
098	23·5	17·7	126	29·5	23·7	154	35·6	29·8
100	24·0	18·2	128	30·0	24·2	156	36·0	30·2
102	24·4	18·6	130	30·4	24·6	158	36·4	30·6
104	24·8	19·0	132	30·8	25·0			
106	25·2	19·4	134	31·3	25·5			

TABLE LXXVIIIE.—Water in Starch.

Starch containing more than 11·4 per cent. of water yields up the excess to alcohol of nsity 0·8339 (90° Tralles), and so the density of the alcohol becomes increased: should e starch contain less than 11·4 per cent., it speedily abstracts the deficit from the alcohol, d so reduces the density of the liquid. Scheibler calculated the table (1) from the nsity of alcohol (0·8339 originally) which had been shaken up with half its weight of arch (100 c.cms. of alcohol with 41·695 grms. of starch), and then filtered.

Saare rinses 100 grms. of potato starch to a tared flask of 250 c.cms. capacity, fills with ater at 17°·5 C., and then weighs again: the results obtained by him are given in able (2).

(1) (Scheibler.)

Density of the Filtered Alcohol.	Percentage of Water in Starch.	Density of the Filtered Alcohol.	Percentage of Water in Starch.	Density of the Filtered Alcohol.	Percentage of Water in Starch.	Density of the Filtered Alcohol.	Percentage of Water in Starch.	Density of the Filtered Alcohol.	Percentage of Water in Starch.	Density of the Filtered Alcohol.	Percentage of Water in Starch.
·8226	0	0·8335	11	0·8455	22	0·8555	33	0·8643	44	0·8723	55
·8234	1	8346	12	8465	23	8563	34	8651	45	8731	56
·8243	2	8358	13	8474	24	8571	35	8658	46	8738	57
·8253	3	8370	14	8484	25	8579	36	8665	47	8745	58
·8262	4	8382	15	8493	26	8587	37	8673	48	8753	59
·8271	5	8394	16	8502	27	8595	38	8680	49	8760	60
·8281	6	8405	17	8511	28	8603	39	8688	50	8767	61
·8291	7	8416	18	8520	29	8612	40	8695	51	8775	62
·8300	8	8426	19	8529	30	8620	41	8703	52	8783	63
·8311	9	8436	20	8538	31	8627	42	8710	53	8791	64
·8323	10	8446	21	8547	32	8635	43	8716	54	8798	65

(2) (Saare.)

Weight of Starch and Water.	Percentage of Water in Starch.	Weight of Starch and Water.	Percentage of Water in Starch.	Weight of Starch and Water.	Percentage of Water in Starch.	Weight of Starch and Water.	Percentage of Water in Starch.	Weight of Starch and Water.	Percentage of Water in Starch.	Weight of Starch and Water.	Percentage of Water in Starch.
289·40	0										
289·00	1	285·05	11	281·10	21	277·20	31	273·25	41	269·30	51
288·60	2	284·65	12	280·75	22	276·80	32	272·85	42	268·90	52
288·20	3	284·25	13	280·35	23	276·40	33	272·45	43	268·50	53
287·80	4	283·90	14	279·95	24	276·00	34	272·05	44	268·10	54
287·40	5	283·50	15	279·55	25	275·60	35	271·70	45	267·75	55
287·05	6	283·10	16	279·15	26	275·20	36	271·30	46	267·35	56
286·65	7	282·70	17	278·75	27	274·80	37	270·90	47	266·95	57
286·25	8	282·30	18	278·35	28	274·40	38	270·50	48	266·55	58
285·85	9	281·90	19	278·00	29	274·05	39	270·10	49	266·15	59
285·45	10	281·50	20	277·60	30	273·65	40	269·70	50	265·75	60

TABLE LXXVIIIF.—**Weights of various Sugars corresponding to Weights of Cupric Oxide precipitated from Fehling's Solution.** (Milligrammes.)

CuO.	Dextrose.	Lævulose.	Maltose.	Invert Sugar.	Milk Sugar.	CuO.	Dextrose.	Lævulose.	Maltose.	Invert Sugar.	Milk Sugar.
13	6·29					53	22·07	20·10	36·25		
14	6·68					54	22·46	20·57	36·96		
15	7·08					55	22·86	21·03	37·67		
16	7·47					56	23·25	21·50	38·38		
17	7·87					57	23·65	21·97	39·09		
18	8·26					58	24·04	22·44	39·80		
19	8·65					59	24·43	22·91	40·51		
20	9·05					60	24·83	23·38	41·22		
21	9·44					61	25·22	23·85	41·93		
22	9·84					62	25·62	24·31	42·64		
23	10·23					63	26·01	24·78	43·35		
24	10·63					64	26·41	25·25	44·06		
25	11·02	7·12				65	26·80	25·72	44·78		
26	11·42	7·59				66	27·20	26·19	45·49		
27	11·81	8·05				67	27·59	26·66	46·20		
28	12·21	8·51				68	27·98	27·13	46·91		
29	12·60	8·97				69	28·38	27·60	47·62		
30	12·99	9·44				70	28·77	28·06	48·33		
31	13·39	9·90				71	29·17	28·53	49·04		
32	13·78	10·36				72	29·56	29·00	49·75		
33	14·18	10·82				73	29·96	29·47	50·46		
34	14·57	11·29				74	30·35	29·94	51·17		
35	14·97	11·75				75	30·75	30·41	51·88		
36	15·36	12·21				76	31·14	30·88	52·59		
37	15·76	12·68				77	31·54	31·36	53·30		
38	16·15	13·14	25·60			78	31·94	31·83	54·01		
39	16·54	13·60	26·31			79	32·35	32·30	54·72		
40	16·94	14·06	27·02			80	32·75	32·78	55·43		
41	17·33	14·53	27·73			81	33·15	33·25	56·14		
42	17·73	14·99	28·44			82	33·55	33·73	56·85		
43	18·12	15·45	29·15			83	33·96	34·20	57·56		
44	18·52	15·91	29·86			84	34·36	34·68	58·27		
45	18·91	16·38	30·57			85	34·76	35·15	58·98		
46	19·31	16·84	31·28			86	35·16	35·63	59·69		
47	19·70	17·30	31·99			87	35·56	36·10	60·40		
48	20·09	17·77	32·70			88	35·97	36·58	61·11		
49	20·49	18·23	33·41			89	36·37	37·05	61·82		
50	20·88	18·69	34·12			90	36·77	37·52	62·53		
51	21·28	19·16	34·83			91	37·17	38·00	63·24		
52	21·67	19·63	35·54			92	37·58	38·47	63·95		

TABLE LXXVIII F.—*continued.*

CuO.	Dextrose.	Lævulose.	Maltose.	Invert Sugar.	Milk Sugar.	CuO.	Dextrose.	Lævulose.	Maltose.	Invert Sugar.	Milk Sugar.
93	37·98	38·95	64·66			**133**	51·07	58·20	93·07	55·48	76·21
94	38·38	39·42	65·37			**134**	51·48	58·69	93·78	55·90	76·81
95	38·78	39·90	66·08			**135**	54·88	59·19	94·49	56·32	77·41
96	39·19	40·37	66·79			**136**	55·28	59·68	95·20	56·74	78·00
97	39·59	40·85	67·50			**137**	55·68	60·17	95·91	57·17	78·60
98	39·99	41·32	68·21			**138**	56·09	60·66	96·62	57·59	79·19
99	40·39	41·79	68·92			**139**	56·49	61·15	97·33	58·01	79·79
100	40·80	42·27	69·63			**140**	56·90	61·65	98·04	58·44	80·39
101	41·20	42·75	70·34			**141**	57·31	62·14	98·75	58·86	80·98
102	41·60	43·23	71·05			**142**	57·72	62·63	99·46	59·28	81·58
103	42·00	43·71	71·76			**143**	58·12	63·12	100·17	59·71	82·17
104	42·41	44·19	72·47			**144**	58·53	63·62	100·88	60·13	82·77
105	42·81	44·67	73·18			**145**	58·94	64·11	101·59	60·45	83·37
106	43·21	45·15	73·89			**146**	59·34	64·60	102·30	60·98	83·96
107	43·61	45·63	74·60			**147**	59·75	65·09	103·01	61·40	84·56
108	44·02	46·11	75·31			**148**	60·16	65·58	103·72	61·82	85·15
109	44·42	46·59	76·02			**149**	60·57	66·08	104·43	62·24	85·75
110	44·82	47·07	76·73			**150**	60·97	66·57	105·14	62·67	86·35
111	45·22	47·55	77·44			**151**	61·38	67·06	105·85	63·09	86·94
112	45·62	48·03	78·15			**152**	61·79	67·55	106·56	63·51	87·54
113	46·03	48·51	78·86	47·01		**153**	62·20	68·04	107·27	63·94	88·13
114	46·43	48·99	79·58	47·44		**154**	62·60	68·53	107·98	64·36	88·73
115	46·83	49·47	80·29	47·86		**155**	63·01	69·02	108·69	64·78	89·33
116	47·23	49·95	81·00	48·28		**156**	63·42	69·51	109·41	65·21	89·92
117	47·64	50·43	81·71	48·71		**157**	63·82	70·00	110·12	65·63	90·52
118	48·04	50·91	82·42	49·13		**158**	64·23	70·49	110·83	66·05	91·11
119	48·44	51·38	83·13	49·55		**159**	64·64	70·98	111·54	66·48	91·71
120	48·84	51·86	83·84	49·97		**160**	65·05	71·47	112·25	66·80	92·31
121	49·25	52·34	84·55	50·40		**161**	65·45	71·96	112·96	67·32	92·90
122	49·65	52·82	85·26	50·82		**162**	65·86	72·45	113·67	67·75	93·50
123	50·05	53·30	85·97	51·24		**163**	66·27	72·94	114·38	68·17	94·09
124	50·45	53·78	86·68	51·67		**194**	66·68	73·43	115·09	68·60	94·69
125	50·86	54·26	87·39	52·09	71·45	**165**	67·08	73·92	115·80	69·03	95·29
126	51·26	54·75	88·10	52·51	72·04	**166**	67·49	74·41	116·51	69·46	95·88
127	51·66	55·25	88·81	52·94	72·64	**167**	67·90	74·90	117·22	69·89	96·48
128	52·06	55·74	89·52	53·36	73·23	**168**	68·31	75·40	117·93	70·32	97·07
129	52·46	56·23	90·23	53·78	73·83	**169**	68·71	75·89	118·64	70·76	97·67
130	52·87	56·72	90·94	54·21	74·42	**170**	69·12	76·38	119·35	71·19	98·27
131	53·27	57·22	91·65	54·63	75·02	**171**	69·53	76·87	120·06	71·62	98·86
132	53·67	57·71	92·36	55·05	75·62	**172**	69·93	77·36	120·77	72·05	99·46

TABLE LXXVIIIF.—*continued.*

CuO.	Dextrose.	Lævulose.	Maltose.	Invert Sugar.	Milk Sugar.	CuO.	Dextrose.	Lævulose.	Maltose.	Invert Sugar.	Milk Sugar.
173	70·34	77·85	121·48	72·48	100·05	**213**	86·92	98·04	149·89	89·72	123·99
174	70·75	78·34	122·19	72·91	100·65	**214**	87·34	98·55	150·60	90·16	124·60
175	71·16	78·83	122·90	73·34	101·25	**215**	87·75	99·06	151·31	90·59	125·20
176	71·56	79·33	123·61	73·77	101·84	**216**	88·17	99·57	152·02	91·03	125·81
177	71·98	79·83	124·32	74·20	102·44	**217**	88·58	100·07	152·73	91·46	126·41
178	72·39	80·34	125·03	74·64	103·03	**218**	89·00	100·58	153·44	91·90	127·01
179	72·81	80·84	125·74	75·07	103·63	**219**	89·41	101·09	154·15	92·33	127·62
180	73·22	81·35	126·45	75·50	104·23	**220**	89·83	101·60	154·86	92·76	128·22
181	73·64	81·85	127·16	75·93	104·82	**221**	90·24	102·11	155·57	93·20	128·82
182	74·05	82·35	127·87	76·36	105·42	**222**	90·66	102·62	156·28	93·64	129·43
183	74·47	82·86	128·58	76·79	106·01	**223**	91·07	103·13	156·99	94·07	130·03
184	74·88	83·36	129·29	77·22	106·61	**224**	91·49	103·64	157·70	94·51	130·64
185	75·30	83·86	130·00	77·65	107·21	**225**	91·90	104·15	158·41	94·94	131·24
186	75·71	84·37	130·71	78·08	107·80	**226**	92·32	104·66	159·12	95·38	131·84
187	76·13	84·87	131·42	78·51	108·40	**227**	92·73	105·18	159·83	95·81	132·45
188	76·54	85·37	132·13	78·95	108·99	**228**	93·15	105·70	160·54	96·25	133·05
189	76·96	85·88	132·84	79·38	109·59	**229**	93·57	106·22	161·25	96·68	133·65
190	77·37	86·38	133·55	79·81	110·19	**230**	93·98	106·73	161·96	97·12	134·26
191	77·79	86·89	134·26	80·24	110·78	**231**	94·40	107·25	162·67	97·56	134·86
192	78·20	87·39	134·97	80·67	111·38	**232**	94·81	107·77	163·38	97·99	135·47
193	78·62	87·89	135·68	81·10	111·97	**233**	95·23	108·29	164·09	98·43	136·07
194	79·04	88·40	136·39	81·53	112·57	**234**	95·64	108·80	164·80	98·86	136·67
195	79·45	88·90	137·10	81·96	113·17	**235**	96·06	109·32	165·51	99·30	137·28
196	79·86	89·40	137·81	82·39	113·76	**236**	96·47	109·84	166·22	99·73	137·88
197	80·28	89·91	138·52	82·83	114·36	**237**	96·89	110·36	166·93	100·17	138·49
198	80·70	90·41	139·23	83·26	114·95	**238**	97·30	110·87	167·64	100·60	139·09
199	81·11	90·92	139·94	83·69	115·55	**239**	97·72	111·39	168·35	101·05	139·69
200	81·53	91·42	140·65	84·12	115·15	**240**	98·15	111·91	169·06	101·50	140·30
201	81·94	91·93	141·36	84·55	116·75	**241**	98·57	112·43	169·77	101·95	140·90
202	82·36	92·44	142·08	84·98	117·35	**242**	98·99	112·94	170·48	102·41	141·50
203	82·77	92·95	142·79	85·41	117·96	**243**	99·42	113·46	171·19	102·86	142·11
204	83·19	93·46	143·50	85·84	118·56	**244**	99·84	113·98	171·90	103·31	142·71
205	83·60	93·97	144·21	86·27	119·17	**245**	100·26	114·50	172·61	103·76	143·32
206	84·02	94·47	144·92	86·71	119·77	**246**	100·69	115·01	173·32	104·21	143·92
207	84·43	94·98	145·63	87·14	120·37	**247**	101·11	115·53	174·04	104·66	144·52
208	84·85	95·49	146·34	87·57	120·98	**248**	101·53	116·05	174·75	105·11	145·13
209	85·26	96·00	147·05	88·00	121·58	**249**	101·96	116·57	175·46	105·56	145·73
210	85·68	96·51	147·76	88·43	122·18	**250**	102·38	117·08	176·17	106·01	146·33
211	86·09	97·02	148·47	88·86	122·79	**251**	102·80	117·60	176·88	106·47	146·94
212	86·51	97·53	149·18	89·29	123·39	**252**	103·23	118·12	177·59	106·92	147·54

TABLE LXXVIIIF.—*continued.*

CuO.	Dextrose.	Lævulose.	Maltose.	Invert Sugar.	Milk Sugar.	CuO	Dextrose.	Lævulose.	Maltose.	Invert Sugar.	Milk Sugar.
253	103·65	118·64	178·30	107·37	148·14	294	121·03	140·37	207·42	125·88	172·90
254	104·07	119·16	179·01	107·82	148·75	295	121·46	140·91	208·13	126·34	173·50
255	104·50	119·67	179·72	108·27	149·35	296	121·89	141·45	208·84	126·80	174·11
256	104·92	120·19	180·43	108·72	149·96	297	122·32	142·00	209·55	127·25	174·71
257	105·34	120·71	181·14	109·17	150·56	298	122·75	142·54	210 26	127·71	175·31
258	105·77	121·23	181·85	109·62	151·16	299	123·18	143·08	210·97	128·16	175·92
259	106·19	121·75	182·56	110·07	151·77	300	123·61	143·63	211·68	128·62	176·52
260	106·61	122·26	183·27	110·52	152·37	301	124·04	144·19	212·39	129·07	177·15
261	107·04	122·78	183·98	110·98	152·98	302	124·47	144·74	213·10	129·53	177·78
262	107·46	123·30	184·69	111·43	153·58	303	124·90	145·30	213·81	129·98	178·41
263	107·88	123·82	185·40	111·88	154·18	304	125·33	145·86	214·52	130·44	179·04
264	108·31	124·34	186·11	112·33	154·79	305	125·76	146·41	215·23	130·89	179·67
265	108·73	124·85	186·82	112·78	155·39	306	126·19	146·97	215·94	131·35	180·30
266	109·15	125·37	187·53	113·23	155·99	307	126·61	147·53	216·65	131·80	180·93
267	109·58	125·89	188·24	113·68	156·60	308	127·04	148·08	217·36	132·26	181·56
268	110·00	126·41	188·95	114·13	157·20	309	127·47	148·64	218·07	132·71	182·19
269	110·42	127·93	189·66	114·58	157·81	310	127·90	149·20	218·78	133·17	182·82
270	110·85	127·44	190·37	115·04	158·41	311	128·33	149·75	219·49	133·62	183·45
271	111·27	127·96	191·08	115·49	159·01	312	128·76	150·31	220·20	134·08	184·08
272	111·69	128·48	191·79	115·94	159·62	313	129·19	150·87	220·91	134·53	184·71
273	112·12	129·00	192·50	116·39	160·22	314	129·62	151·42	221·62	134·99	185·33
274	112·54	129·52	193·21	116·84	160·82	315	130·05	151·98	222·33	135·45	185·96
275	112·96	130·03	193·92	117·29	161·43	316	130·48	152·54	223·04	135·91	186·59
276	113·39	130·58	194·63	117·74	162·03	317	130·91	153·09	223·75	136·37	187·22
277	113·81	131·12	195·34	118·19	162·64	318	131·34	153·65	224·46	136·83	187·85
278	114·23	131·67	196·05	118·64	163·24	319	131·77	154·21	225·17	137·28	188·18
279	114·66	132·21	196·76	119·10	163·84	320	132·19	154·76	225·88	137·74	189·11
280	115·08	132·75	197·47	119·55	164·45	321	132·62	155·32	226 59	138·20	189·74
281	115·50	133·30	198·18	120·00	165·05	322	133·05	155·88	227·30	138·66	190·37
282	115·92	133·84	198·89	120·45	165·65	323	133·48	156·43	228·01	139·12	191·00
283	116·35	134·38	199·60	120·90	166·26	324	133·91	156·99	228·72	139·68	191·63
284	116·77	134·93	200·31	121·35	166·86	325	134·34	157·55	229·43	140·04	192·26
285	117·19	135·47	201·02	121·80	167·47	326	134·77	158·09	230·14	140·50	192·89
286	117·62	136·01	201·73	122·25	168·07	327	135·20	158·63	230·85	140·96	193·52
287	118·04	136·56	202·44	122·70	168·67	328	135·63	159·17	231·56	141·42	194·15
288	118·46	137·10	203·15	123·15	169·28	329	136·06	159·71	232·27	141·88	194·78
289	118·89	137·65	203·86	123·61	169·88	330	136·49	160·25	232·98	142·33	195·11
290	119·32	138·19	204·57	124·06	170·48	331	136·92	160·78	233·69	142·79	196·01
291	119·75	138·73	205·28	124·52	171·09	332	137·34	161·32	234·10	143·25	196·67
292	120·18	139·28	205·99	124·98	171·69	333	137·77	161·86	235·11	143·71	197·30
293	120·60	139·82	206·71	125·43	172·29	334	138·20	162·40	235·82	144·17	197·93

TABLE LXXVIIIF.—*continued.*

CuO.	Dextrose.	Lævulose.	Maltose.	Invert Sugar.	Milk Sugar.	CuO	Dextrose.	Lævulose.	Maltose.	Invert Sugar.	Milk Sugar.
335	138·63	162·91	236·53	144·63	198·56	**376**	156 60	185·75		163·84	224·37
336	139·06	163·48	237·24	145·09	199·19	**377**	157·04	186·32		164·33	225·00
337	139·49	164·02	237·95	145·55	199·81	**378**	157·47	186·90		164·81	225·63
338	139·92	164·56	238·66	146·01	200·44	**379**	157·91	187·47		165·28	226·26
339	140·35	165·10	239·38	146·47	201·07	**380**	158·35	188·04		165·75	226·89
340	140·79	165·64	240·09	146·94	201·70	**381**	185·79	188·61		166·23	227·52
341	141·23	166·18	240·80	147·41	202·33	**382**	159·23	189·18		166·70	228·15
342	141·67	166·72	241·51	147·87	202·96	**383**	159·67	189·76		167·18	228·78
343	142·11	167·26	242·22	148·34	203·59	**384**	160·11	190·33		167 65	229·41
344	142·54	167·80	242·93	148·81	204·22	**385**	160·55	190·90		168·13	230·03
345	142·98	168·33	243·64	149·28	204·85	**386**	160·99	191·47		168·60	230·66
346	143·42	168·87	244·35	149·74	205·48	**387**	161·43	192·04		169·08	231·29
347	143·86	169·41	245·06	150·21	206·11	**388**	161·87	192·61		169·55	231·92
348	144·30	169·95	245·77	150·68	206·74	**389**	162·30	193·19		170·03	232·55
349	144·74	170·49	246·48	151·14	207·37	**390**	162·74	193·76		170·50	233·18
350	145·18	171·03	247·19	151·61	208·00	**391**	163·18	194·33		170·98	233·81
351	145·62	171·60	247·90	152·08	208·63	**392**	163·62	194·90		171·45	234·44
352	146·06	172·16	248·61	152·54	209·26	**393**	164·06	195·47		171 93	235·07
353	146·50	172·73	249·32	153·01	209·89	**394**	164·50	196·04		172·40	235·70
354	147·94	173 29	250·03	153·48	210·52	**395**	164·94	196·62		172·88	236·33
355	147·37	173·86	250·74	153·94	211·15	**396**	165·38	197·19		173·35	236·96
356	147·81	174·43	251·45	154·41	211·78	**397**	165·82	197·76		173·83	237·59
357	148·25	174·99	252·16	154·88	212·41	**398**	166·26	198·33		174·30	238·22
358	148·69	175·56	252·87	155·35	213·04	**399**	166·70	198·90		174·78	238·85
359	149·13	176·12	253·58	155·81	213·67	**400**	167·13	199·48		175·25	239·48
360	149·57	176·92	254·29	156·28	214·30	**401**	167·57	200·06		175·73	240·14
361	150·01	177·26	255·00	156·75	214·92	**402**	168·02	200·65		176·20	240·80
362	150·45	177·82	255·71	157·21	215·55	**403**	168·47	201·24		176·68	241·46
363	150·89	178·39	256·42	157·68	216 18	**404**	168·92	201·83		177·15	242·12
364	151·33	178·95	257·13	158·15	216·81	**405**	169·36	202·42		177·63	242·78
365	151·77	179·52	257·84	158·63	217·44	**406**	169·81	203·01		178·10	243·44
366	152·20	180·09	258·55	158·11	218·07	**407**	170·26	203·60		178·58	244·11
367	152·64	180·65	259·26	159·58	218·70	**408**	170·70	204·19		179·05	244·77
368	153·08	181·22	259·97	160·06	219·33	**409**	171·15	204·78		179·53	245·43
369	153·52	181·78	260·68	160·53	219·96	**410**	171·60	205·36		180·00	246·09
370	153·96	182·35	261·39	161·01	220·59	**411**	172·05	205·95		180·48	246·75
371	154·40	182·92	262·10	161·48	221·22	**412**	172·49	206·54		180·95	247·41
372	154·84	183·48	262·81	161·96	221·85	**413**	172 94	207·13		181·43	248·07
373	155·28	184·05	263·52	162·43	222·48	**414**	173·39	207·72		181·91	248·73
374	155·72	184·61	264·23	162·91	223·11	**415**	173·83	208·31		182·40	249·40
375	156·16	185·18	264·94	163·38	223·74	**416**	174·28	208·90		182·89	250·06

TABLE LXXVIIIF.—*continued.*

CuO.	Dextrose.	Lævulose.	Maltose.	Invert Sugar.	Milk Sugar.	CuO.	Dextrose.	Lævulose.	Maltose.	Invert Sugar.	Milk Sugar.
417	174·73	209·49		183·38	250·72	**458**	193·21	233·84		203·42	277·82
418	175·18	210·08		183·86	251·38	**459**	193·67	234·42		203·91	278·49
419	175·62	210·66		184·35	252·04	**460**	194·12	235·00		204·40	279·15
420	176·07	211·25		184·83	252·70	**461**	194·58	235·58		204·89	279·81
421	176·52	211·84		185·32	253·36	**462**	195·03	236·16		205·38	280·47
422	176·96	212·43		185·81	254·02	**463**	195·49	236·74		205·87	281·13
423	177·41	213·02		186·30	254·68	**464**	195·94	237·32		206·37	281·79
424	177·86	213·61		186·78	255·35	**465**	196·40	237·90		206·88	282·45
425	178·31	214·20		187·27	256·01	**466**	196·86	238·48		207·38	283·11
426	178·75	214·80		187·76	256·67	**467**	197·31	239·06		207·88	283·77
427	179·20	215·40		188·24	257·33	**468**	197·77	239·64		208·38	284·44
428	179·65	216·00		188·73	257·99	**469**	198·22	240·22		208·89	285·10
429	180·10	216·60		189·22	258·65	**470**	198·68	240·81		209·39	285·76
430	180·54	217·20		189·70	259·31	**471**	199·13	241·39		209·89	286·42
431	180·99	217·80		190·19	259·97	**472**	199·59	241·97		210·39	287·08
432	181·44	218·40		190·68	260·63	**473**	200·04	242·55		210·90	287·74
433	181·88	219·00		191·16	261·30	**474**	200·50	243·13		211·40	288·40
434	182·33	219·60		191·65	261·96	**475**	200·95	243·71		211·90	289·06
435	182·78	220·19		192·14	262·62	**476**	201·41	244·44		212·40	289·72
436	183·23	220·79		192·62	263·28	**477**	201·86	245·16		212·91	290·39
437	183·67	221·39		193·11	263·94	**478**	202·32	245·89		213·41	291·05
438	184·12	221·99		193·60	264·60	**479**	202·77	246·62		213·91	291·71
439	184·57	222·59		194·09	265·26	**480**	203·23	247·35		214·42	292·37
440	185·02	223·19		194·58	265·92	**481**	203·68	248·08		214·92	293·03
441	185·48	223·79		195·07	266·59	**482**	204·14	248·80		215·42	293·69
442	185·93	224·39		195·56	267·25	**483**	204·59			215·92	294·35
443	186·39	224·99		196·05	267·91	**484**	205·05			216·43	295·01
444	186·84	225·59		196·54	268·57	**485**	205·50			216·93	295·68
445	187·30	226·19		197·03	269·23	**486**	205·96			217·43	296·34
446	187·75	226·79		197·53	269·89	**487**	206·41			217·93	297·00
447	188·21	227·39		198·02	270·55	**488**	206·87			218·44	297·66
448	188·66	227·99		198·51	271·21	**489**	207·32			218·97	298·32
449	189·12	228·59		199·00	271·87	**490**	207·78			219·51	298·98
450	189·57	229·19		199·49	272·53	**491**	208·25			220·04	299·61
451	190·03	229·77		199·98	273·20	**492**	208·71			220·57	300·30
452	190·48	230·35		200·47	273·86	**493**	209·18			221·11	300·96
453	190·94	230·93		200·96	274·52	**494**	209·64			221·64	301·63
454	191·39	231·51		201·45	275 18	**495**	210·10			222·18	302·29
455	191·85	232·09		201·94	275·84	**496**	210·57			222·71	302·95
456	192·30	232·67		202·43	276·50	**497**	211·03			223·25	303·61
457	192·76	233·26		202·93	277·16	**498**	211·49			223·78	304·27

TABLE LXXVIIIF.—*continued.*

CuO.	Dextrose.	Lævulose.	Maltose.	Invert Sugar.	Milk Sugar.	CuO.	Dextrose.	Lævulose.	Maltose.	Invert Sugar.	Milk Sugar.
499	211·96			224·32	304·93	539	230·58				
500	212·42			224·85	305·59	540	231·05				
501	212·88			225·38		541	231·52				
502	213·34			225·92		542	231·99				
503	213·81			226·45		543	232·46				
504	214·27			226·99		544	232·93				
505	214·73			227·52		545	233·40				
506	215·20			228·06		546	233·87				
507	215·66			228·59		547	234·34				
508	216·12			229·12		548	234·82				
509	216·59			229·66		549	235·29				
510	217·05			230·19		550	235·76				
511	217·51			230·73		551	236·23				
512	217·98			231·26		552	236·70				
513	218·44			231·80		553	237·17				
514	218·90			232·36		554	237·64				
515	219·37			232·93		555	238·11				
516	219·83			233·49		556	238·58				
517	220·29			234·06		557	239·06				
518	220·76			234·63		558	239·53				
519	221·22			235·19		559	240·00				
520	221·68			235·76		560	240·47				
521	222·15			336·32		561	240·94				
522	222·61			236·89		562	241·41				
523	223·07			237·46		563	241·88				
524	223·53			238·02		564	242·35				
525	224·00			238·59		565	242·82				
526	224·46			239·15		566	243·29				
527	224·93			239·72		567	243·77				
528	225·40			240·29		568	244·24				
529	225·87			240·85		569	244·71				
530	226·34			241·42		570	245·18				
531	226·81			241·98		571	245·65				
532	227·28			242·55		572	246·12				
533	227·75			243·12		573	246·59				
534	228·22			243·68		574	247·06				
535	228·69			244·25		575	247·53				
536	229·16			244·81		576	248·00				
537	229·63			245·38							
538	230·11			245·95							

TABLE LXXVIIIG.—**Weight of various Sugars corresponding to Weights of Copper precipitated from Fehling's Solution.** (Milligrammes.)

Copper.	Dextrose.	Lævulose.	Maltose.	Invert Sugar.	Milk Sugar.	Copper.	Dextrose.	Lævulose.	Maltose.	Invert Sugar.	Milk Sugar.
10	6·1					50	25·9	24·59	42·6		
11	6·6					51	26·4	25·18	43·5		
12	7·1					52	26·9	25·76	44·4		
13	7·6					53	27·4	26·35	45·2		
14	8·1					54	27·9	26·93	46·1		
15	8·6					55	28·4	27·52	47·0		
16	9·0					56	28·8	28·17	47·8		
17	9·5					57	29·3	28·70	48·7		
18	10·0					58	29·8	29·30	49·6		
19	10·5					59	30·3	29·89	50·4		
20	11·0	7·15				60	30·8	30·48	51·3		
21	11·5	7·78				61	31·3	31·07	52·2		
22	12·0	8·41				62	31·8	31·66	53·1		
23	12·5	9·01				63	32·3	32·25	53·9		
24	13·0	9·67				64	32·8	32·84	54·8		
25	13·5	10·30				65	33·3	33·43	55·7		
26	14·0	10·81				66	33·8	34·02	56·6		
27	14·5	11·33				67	34·3	34·62	57·4		
28	15·0	11·84				68	34·8	35·21	58·3		
29	15·5	12·36				69	35·3	35·81	59·2		
30	16·0	12·87	25·3			70	35·8	36·40	60·1		
31	16·5	13·46	26·1			71	36·3	37·00	61·0		
32	17·0	14·05	27·0			72	36·8	37·59	61·8		
33	17·5	14·64	27·9			73	37·3	38·19	62·7		
34	18·0	15·23	28·7			74	37·8	38·78	63·6		
35	18·5	15·82	29·6			75	38·3	39·38	64·5		
36	18·9	16·40	30·5			76	38·8	39·98	65·4		
37	19·4	16·99	31·3			77	39·3	40·58	66·2		
38	19·9	17·57	32·2			78	39·8	41·17	67·1		
39	20·4	18·16	33·1			79	40·3	41·77	68·0		
40	20·9	18·74	33·9			80	40·8	42·37	68·9		
41	21·4	19·32	34·8			81	41·3	42·97	69·7		
42	21·9	19·91	35·7			82	41·8	43·57	70·6		
43	22·4	20·49	36·5			83	42·3	44·16	71·5		
44	22·9	21·08	37·4			84	42·8	44·76	72·4		
45	23·4	21·66	38·3			85	43·4	45·37	73·2		
46	23·9	22·25	39·1			86	43·9	45·96	74·1		
47	24·4	22·83	40·0			87	44·4	46·57	75·0		
48	24·9	23·42	40·9			88	44·9	47·17	75·9		
49	25·4	24·00	41·8			89	45·4	47·78	76·8		

TABLE LXXVIIIG.—*continued.*

Copper.	Dextrose.	Lævulose.	Maltose.	Invert Sugar.	Milk Sugar.	Copper.	Dextrose.	Lævulose.	Maltose.	Invert Sugar.	Milk Sugar.
90	45·9	48·38	77·7	46·9		**130**	66·2	72·81	113·4	68·1	93·8
91	46·4	48·98	78·6	47·4		**131**	66·7	73·43	114·3	68·7	94·6
92	46·9	49·58	79·5	47·9		**132**	67·2	74·05	115·2	69·2	95·3
93.	47·4	50·18	80·3	48·4		**133**	67·7	74·67	116·1	69·7	96·1
94	47·9	50·78	81·2	48·9		**134**	68·2	75·29	117·0	70·3	96·9
95	48·4	51·38	82·1	49·5		**135**	68·8	75·91	117·9	70·8	97·6
96	48·9	51·98	83·0	50·0		**136**	69·3	76·53	118·8	71·3	98·3
97	49·4	52·58	83·9	50·5		**137**	69·8	77·15	119·7	71·9	99·1
98	49·9	53·19	84·8	51·1		**138**	70·3	77·77	120·6	72·4	99·8
99	50·4	53·79	85·7	51·6		**139**	70·8	78·39	121·5	72·9	100·5
100	50·9	54·39	86·6	52·1	71·6	**140**	71·3	79·01	122·4	73·5	101·3
101	51·4	55·00	87·5	52·7	72·4	**141**	71·8	79·64	123·3	74·0	102·0
102	51·9	55·62	88·4	53·2	73·1	**142**	72·3	80·28	124·2	74·5	102·8
103	52·4	56·23	89·2	53·7	73·8	**143**	72·9	80·91	125·1	75·1	103·5
104	52·9	56·85	90·1	54·3	74·6	**144**	73·4	81·55	126·0	75·6	104·3
105	53·5	57·46	91·0	54·8	75·3	**145**	73·9	82·18	126·9	76·1	105·1
106	54·0	58·07	91·9	55·3	76·1	**146**	74·4	82·81	127·8	76·7	105·8
107	54·5	58·68	92·8	55·9	76·8	**147**	74·9	83·43	128·7	77·2	106·6
108	55·0	59·30	93·7	56·4	77·6	**148**	75·5	84·06	129·6	77·8	107·3
109	55·5	59·91	94·6	56·9	78·3	**149**	76·0	84·68	130·5	78·3	108·1
110	56·0	60·52	95·5	57·5	79·0	**150**	76·5	85·31	131·4	78·9	108·8
111	56·5	61·13	96·4	58·0	79·8	**151**	77·0	85·93	132·3	79·4	109·6
112	57·0	61·74	97·3	58·5	80·5	**152**	77·5	86·55	133·2	80·0	110·3
113	57·5	62·36	98·1	59·1	81·3	**153**	78·1	87·16	134·1	80·5	111·1
114	58·0	62·97	99·0	59·6	82·0	**154**	78·6	87·78	135·0	81·0	111·9
115	58·6	63·58	99·9	60·1	82·7	**155**	79·1	88·40	135·9	81·6	112·6
116	59·1	64·21	100·8	60·7	83·5	**156**	79·6	89·05	136·8	82·1	113·4
117	59·6	64·84	101·7	61·2	84·2	**157**	80·1	89·69	137·7	82·7	114·1
118	60·1	65·46	102·6	61·7	85·0	**158**	80·7	90·34	138·6	83·2	114·9
119	60·6	66·09	103·5	62·3	85·7	**159**	81·2	90·98	139·5	83·8	115·6
120	61·1	66·72	104·4	62·8	86·4	**160**	81·7	91·63	140·4	84·3	116·4
121	61·6	67·32	105·3	63·3	87·2	**161**	82·2	92·26	141·3	84·8	117·1
122	62·1	67·92	106·2	63·9	87·9	**162**	82·7	92·90	142·2	85·4	117·9
123	62·6	68 53	107·1	64·4	88·7	**163**	83·3	93·53	143·1	85·9	118·6
124	63·1	69·13	108·0	64·9	89·4	**164**	83·8	94·17	144·0	86·5	119·4
125	63·7	69·73	108·9	65·5	90·1	**165**	84·3	94·80	144·9	87·0	120·2
126	64·2	70·35	109·8	66·0	90·9	**166**	84·8	95·44	145·8	87·6	120·9
127	64·7	70·96	110·7	66·5	91·6	**167**	85·3	96·08	146·7	88·1	121·7
128	65·2	71·58	111·6	67·1	92·4	**168**	85·9	96·71	147·6	88·6	122·4
129	65·7	72·19	112·5	67·6	93·1	**169**	86·4	97·35	148·5	89·2	123·2

TABLE LXXVIIIG.—*continued.*

Copper.	Dextrose.	Lævulose.	Maltose.	Invert Sugar.	Milk Sugar.	Copper.	Dextrose.	Lævulose.	Maltose.	Invert Sugar.	Milk Sugar.
170	86·9	97·99	149·4	89·7	123·9	**210**	107·9	123·92	185·0	111·9	154·5
171	87·4	98·63	150·3	90·3	124·7	**211**	108·4	124·58	185·9	112·5	155·2
172	87·9	99·27	151·2	90·8	125·5	**212**	109·0	125·24	186·8	113·0	156·0
173	88·5	99·90	152·0	91·4	126·2	**213**	109·5	125·90	187·7	113·6	156·7
174	89·0	100·54	152·9	91·9	127·0	**214**	110·0	126·56	188·6	114·2	157·5
175	89·5	101·18	153·8	92·4	127·8	**215**	110·6	127·22	189·5	114·7	158·2
176	90·0	101·82	154·7	93·0	128·5	**216**	111·1	127·85	190·4	115·3	159·0
177	90·5	102·46	155·6	93·5	129·3	**217**	111·6	128·48	191·2	115·8	159·7
178	91·1	103·11	156·5	94·1	130·1	**218**	112·1	129·10	192·1	116·4	160·4
179	91·6	103·75	157·4	94·6	130·8	**219**	112·7	129·73	193·0	117·0	161·2
180	92·1	104·39	158·3	95·2	131·6	**220**	113·2	130·36	193·9	117·5	161·9
181	92·6	105·01	159·2	95·7	132·4	**221**	113·7	131·01	194·8	118·1	162·7
182	93·1	105·68	160·1	96·2	133·1	**222**	114·3	131·77	195·7	118·7	163·4
183	93·7	106·33	160·9	96·8	133·9	**223**	114·8	132·48	196·6	119·2	164·2
184	94·2	106·97	161·8	97·3	134·7	**224**	115·3	133·18	197·5	119·8	164·9
185	94·7	107·62	162·7	97·8	135·4	**225**	115·9	133·89	198·4	120·4	165·7
186	95·2	108·27	163·6	98·4	136·2	**226**	116·4	134·56	199·3	120·9	166·4
187	95·7	108·92	164·5	99·0	137·0	**227**	116·9	135·23	200·2	121·5	167·2
188	96·3	109·56	165·4	99·5	137·7	**228**	117·4	135·89	201·1	122·1	167·9
189	96·8	110·21	166·3	100·1	138·5	**229**	118·0	136·56	202·0	122·6	168·6
190	97·3	110·86	167·2	100·6	139·3	**230**	118·5	137·23	202·9	123·2	169·4
191	97·8	111·50	168·1	101·2	140·0	**231**	119·0	137·90	203·8	123·8	170·1
192	98·4	112·14	169·0	101·7	140·8	**232**	119·6	138·57	204·7	124·3	170·9
193	98·9	112·78	169·8	102·3	141·6	**233**	120·1	139·25	205·6	124·9	171·6
194	99·4	113·42	170·7	102·9	142·3	**234**	120·7	139·92	206·5	125·5	172·4
195	100·0	114·06	171·6	103·4	143·1	**235**	121·2	140·59	207·4	126·0	173·1
196	100·5	114·72	172·5	104·0	143·9	**236**	121·7	141·27	208·3	126·6	173·9
197	101·0	115·38	173·4	104·6	144·6	**237**	122·3	141·94	209·1	127·2	174·6
198	101·5	116·04	174·3	105·1	145·4	**238**	122·8	142·62	210·0	127·8	175·4
199	102·0	116·70	175·2	105·7	146·2	**239**	123·4	143·29	210·9	128·3	176·2
200	102·6	117·36	176·1	106·3	146·9	**240**	123·9	143·97	211·8	128·9	176·9
201	103·2	118·02	177·0	106·8	147·7	**241**	124·4	144·65	212·7	129·5	177·7
202	103·7	118·68	177·9	107·4	148·5	**242**	125·0	145·32	213·6	130·0	178·5
203	104·2	119·33	178·7	107·9	149·2	**243**	125·5	146·00	214·5	130·6	179·3
204	104·7	119·99	179·6	108·5	150·0	**244**	126·0	146·67	215·4	131·2	180·1
205	105·3	120·65	180·5	109·1	150·7	**245**	126·6	147·35	216·3	131·8	180·8
206	105·8	121·30	181·4	109·6	151·5	**246**	127·1	148·03	217·2	132·3	181·6
207	106·3	121·96	182·3	110·2	152·2	**247**	127·6	148·71	218·1	132·9	182·4
208	106·8	122·61	183·2	110·8	153·0	**248**	128·1	149·40	219·0	133·5	183·2
209	107·4	123·27	184·1	111·3	153·7	**249**	128·7	150·08	219·9	134·1	184·0

TABLE LXXVIIIG.—*continued.*

Copper.	Dextrose.	Lævulose.	Maltose.	Invert Sugar.	Milk Sugar.	Copper.	Dextrose.	Lævulose.	Maltose.	Invert Sugar.	Milk Sugar.
250	129·2	150·76	220·8	134·6	184·8	**290**	151·0	178·53	256·6	157·8	216·3
251	129·7	151·44	221·7	135·2	185·5	**291**	151·6	179·24	257·5	158·4	217·1
252	130·3	152·12	222·6	135·8	186·3	**292**	152·1	179·95	258·4	159·0	217·9
253	130·8	152·81	223·5	136·3	187·1	**293**	152·7	180·65	259·3	159·6	218·7
254	131·4	153·49	224·4	136·9	187·9	**294**	153·2	181·36	260·2	160·2	219·5
255	131·9	154·17	225·3	137·5	188·7	**295**	153·8	182·07	261·1	160·8	220·3
256	132·4	154·91	226·2	138·1	189·4	**296**	154·3	182·78	262·0	161·4	221·1
257	133·0	155·65	227·1	138·6	190·2	**297**	154·9	183·49	262·8	162·0	221·9
258	133·5	156·40	228·0	139·2	191·0	**298**	155·4	184·21	263·7	162·6	222·7
259	134·1	157·14	228·9	139·8	191·8	**299**	156·0	184·92	264·6	163·2	223·5
260	134·6	157·88	229·8	140·4	192·5	**300**	156·5	185·63	265·5	163·8	224·4
261	135·1	158·49	230·7	140·9	193·3	**301**	157·1	186·35		164·4	225·2
262	135·7	159·09	231·6	141·5	194·1	**302**	157·6	187·06		165·0	225·9
263	136·2	159·70	232·5	142·1	194·9	**303**	158·2	187·78		165·6	226·7
264	136·8	160·30	233·4	142·7	195·7	**304**	158·7	188·49		166·2	227·5
265	137·3	160·91	234·3	143·2	196·4	**305**	159·3	189·21		166·8	228·3
266	137·8	161·63	235·2	143·8	197·2	**306**	159·8	189·93		167·3	229·1
267	138·4	162·35	236·1	144·4	198·0	**307**	160·4	190·65		167·9	229·8
268	138·9	163·07	237·0	144·9	198·8	**308**	160·9	191·37		168·5	230·6
269	139·5	163·79	237·9	145·5	199·5	**309**	161·5	192·09		169·1	231·4
270	140·0	164·51	238·8	146·1	200·3	**310**	162·0	192·81		169·7	232·2
271	140·6	165·21	239·7	146·7	201·1	**311**	162·6	193·45		170·3	232·9
272	141·1	165·90	240·6	147·2	201·9	**312**	163·1	194·25		170·9	233·7
273	141·7	166·60	241·5	147·8	202·7	**313**	163·7	194·97		171·5	234·5
274	142·2	167·29	242·4	148·4	203·5	**314**	164·2	195·69		172·1	235·3
275	142·8	167·99	243·3	149·0	204·3	**315**	164·8	196·41		172·7	236·1
276	143·3	168·68	244·2	149·5	205·1	**316**	165·3	197·12		173·3	236·8
277	143·9	169·37	245·1	150·1	205·9	**317**	165·9	197·83		173·9	237·6
278	144·4	170·06	246·0	150·7	206·7	**318**	166·4	198·59		174·5	238·4
279	145·0	170·75	246·9	151·3	207·5	**319**	167·0	199·26		175·1	239·2
280	145·5	171·44	247·8	151·9	208·3	**320**	167·5	199·97		175·6	240·0
281	146·1	172·14	248·7	152·5	209·1	**321**	168·1	200·71		176·2	240·7
282	146·6	172·85	249·6	153·1	209·9	**322**	168·6	201·44		176·8	241·5
283	147·2	173·55	250·4	153·7	210·7	**323**	169·2	202·18		177·4	242·3
284	147·7	174·26	251·3	154·3	211·5	**324**	169·7	202·91		178·0	243·1
285	148·3	174·96	252·2	154·9	212·3	**325**	170·3	203·65		178·6	243·9
286	148·8	175·67	253·1	155·5	213·1	**326**	170·9	204·39		179·2	244·6
287	149·4	176·39	254·0	156·1	213·9	**327**	171·4	205·13		179·8	245·4
288	149·9	177·10	254·9	156·7	214·7	**328**	172·0	205·88		180·4	246·2
289	150·5	177·82	255·8	157·2	215·5	**329**	172·5	206·62		181·0	247·0

TABLE LXXVIII*a*.—*continued*.

Copper.	Dextrose.	Lævulose.	Maltose.	Invert Sugar.	Milk Sugar.	Copper.	Dextrose.	Lævulose.	Maltose.	Invert Sugar.	Milk Sugar.
330	173·1	207·36		181·6	247·7	**370**	195·7	237·39		206·1	280·5
331	173·7	208·10		182·2	248·5	**371**	196·3	238·16		206·7	281·4
332	174·2	208·83		182·8	249·2	**372**	196·8	238·93		207·3	282·2
333	174·8	209·57		183·5	250·0	**373**	197·4	239·69		208·0	283·1
334	175·3	210·30		184·1	250·8	**374**	198·0	240·46		208·6	283·9
335	175·9	211·04		184·7	251·6	**375**	198·6	241·23		209·2	284·8
336	176·5	211·78		185·4	252·5	**376**	199·1	241·87		209·9	285·7
337	177·0	212·52		186·0	253·3	**377**	199·7	242·51		210·5	286·5
338	177·6	213·25		186·6	254·1	**378**	200·3	243·15		211·1	287·4
339	178·1	213·99		187·2	254·9	**379**	200·8	243·79		211·7	288·2
340	178·7	214·73		187·8	255·7	**380**	201·4	244·43		212·4	289·1
341	179·3	215·48		188·4	256·5	**381**	202·0	245·34		213·0	289·9
342	179·8	216·23		189·0	257·4	**382**	202·5	246·25		213·6	290·8
343	180·4	216·97		189·6	258·2	**383**	203·1	247·17		214·3	291·7
344	180·9	217·72		190·2	259·0	**384**	203·7	248·08		214·9	292·5
345	181·5	218·47		190·8	259·8	**385**	204·3	248·99		215·5	293·4
346	182·1	219·21		191·4	260·6	**386**	204·8			216·1	294·2
347	182·6	219·97		192·0	261·4	**387**	205·4			216·8	295·1
348	183·2	220·71		192·6	262·3	**388**	206·0			217·4	296·0
349	183·7	221·46		193·2	263·1	**389**	206·5			218·0	296·8
350	184·3	222·21		193·8	263·9	**390**	207·1			218·7	297·7
351	184·9	222·96		194·4	264·7	**391**	207·7			219·3	298·5
352	185·4	223·72		195·0	265·5	**392**	208·3			219·9	299·4
353	186·0	224·47		195·6	266·3	**393**	208·8			220·5	300·3
354	186·6	225·23		196·2	267·2	**394**	209·4			221·2	301·1
355	187·2	225·98		196·8	268·0	**395**	210·0			221·8	302·0
356	187·7	226·74		197·4	268·8	**396**	210·6			222·4	302·8
357	188·3	227·49		198·0	269·6	**397**	211·2			223·1	303·7
358	188·9	228·25		198·6	270·4	**398**	211·7			223·7	304·6
359	189·4	229·00		199·2	271·2	**399**	212·3			224·3	305·4
360	190·0	229·76		199·8	272·1	**400**	212·9			224·9	306·3
361	190·6	230·52		200·4	272·9	**401**	213·5			225·7	
362	191·1	231·28		201·1	273·7	**402**	214·1			226·4	
363	191·7	232·05		201·7	274·5	**403**	214·6			227·1	
364	192·3	232·81		202·3	275·3	**404**	215·2			227·8	
365	192·9	233·57		203·0	276·2	**405**	215·8			228·6	
366	193·4	234·33		203·6	277·1	**406**	216·4			229·3	
367	194·0	235·10		204·2	277·9	**407**	217·0			230·0	
368	194·6	235·86		204·8	278·8	**408**	217·5			230·7	
369	195·1	236·63		205·5	279·6	**409**	218·1			231·4	

TABLE LXXVIIIG.—*continued.*

Copper.	Dextrose.	Lævulose.	Maltose.	Invert Sugar.	Milk Sugar.	Copper.	Dextrose.	Lævulose.	Maltose.	Invert Sugar.	Milk Sugar.
410	218·7			232·1		**437**	234·5				
411	219·3			232·8		**438**	235·1				
412	219·9			233·5		**439**	235·7				
413	220·4			234·3		**440**	236·3				
414	221·0			235·0		**441**	236·9				
415	221·6			235·7		**442**	237·5				
416	222·2			236·4		**443**	238·1				
417	222·8			237·1		**444**	238·7				
418	223·3			237·8		**445**	239·3				
419	223·9			238·5		**446**	239·8				
420	224·5			239·2		**447**	240·4				
421	225·1			239·9		**448**	241·0				
422	225·7			240·6		**449**	241·6				
423	226·3			241·3		**450**	242·2				
424	226·9			242·0		**451**	242·8				
425	227·5			242·7		**452**	243·4				
426	228·0			243·4		**453**	244·0				
427	228·6			244·1		**454**	244·6				
428	229·2			244·9		**455**	245·2				
429	229·8			245·6		**456**	245·7				
430	230·4			246·3		**457**	246·3				
431	231·0					**458**	246·9				
432	231·6					**459**	247·5				
433	232·2					**460**	248·1				
434	232·8					**461**	248·7				
435	233·4					**462**	249·3				
436	233·9					**463**	249·9				

TABLE LXXVIIIh.—Approximate Amount of Solids (dried at 70° to 75° C.) contained in Worts, Infusions, clear Extracts of Malt, and De-alcoholised Beers. (Schultze-Ostermann.)

Specific Gravity at 15° C.	Weight of Extract per cent.	Specific Gravity at 15° C.	Weight of Extract per cent.	Specific Gravity at 15° C.	Weight of Extract per cent.	Specific Gravity at 15° C.	Weight of Extract per cent.	Specific Gravity at 15° C.	Weight of Extract per cent.
		1·0050	1·313	1·0100	2·616	1·0150	3·907	1·0200	5·186
1·0001	0·026	51	339	01	642	51	933	01	211
2	053	52	365	02	667	52	959	02	237
3	079	53	392	03	693	53	984	03	262
4	105	54	418	04	719	54	4·010	04	288
5	132	55	444	05	745	55	036	05	313
6	158	56	470	06	771	56	061	06	338
7	184	57	496	07	797	57	087	07	364
8	211	58	522	08	823	58	112	08	389
9	237	59	548	09	849	59	138	09	415
1·0010	263	1·0060	574	1·0110	875	1·0160	164	1·0210	440
11	290	61	600	11	901	61	189	11	466
12	316	62	627	12	927	62	215	12	491
13	342	63	653	13	953	63	240	13	517
14	368	64	679	14	979	64	266	14	542
15	395	65	705	15	3·005	65	291	15	567
16	421	66	731	16	031	66	317	16	593
17	447	67	757	17	057	67	343	17	618
18	474	68	783	18	082	68	368	18	644
19	500	69	809	19	108	69	394	19	669
1·0020	526	1·0070	835	1·0120	134	1·0170	419	1·0220	695
21	553	71	862	21	160	71	415	21	720
22	579	72	888	22	186	72	470	22	746
23	605	73	914	23	211	73	496	23	771
24	632	74	940	24	237	74	522	24	796
25	658	75	966	25	263	75	517	25	822
26	684	76	992	26	289	76	573	26	847
27	711	77	2·018	27	314	77	598	27	873
28	737	78	044	28	340	78	624	28	898
29	763	79	070	29	366	79	650	29	924
1·0030	790	1·0080	096	1·0130	392	1·0180	675	1·0230	949
31	816	81	122	31	417	81	701	31	975
32	842	82	148	32	413	82	726	32	6·000
33	868	83	174	33	469	83	752	33	025
34	895	84	200	34	495	84	777	34	051
35	921	85	226	35	521	85	803	35	076
36	947	86	252	36	516	86	829	36	101
37	974	87	278	37	572	87	854	37	126
38	1·000	88	304	38	598	88	880	38	151
39	026	89	330	39	624	89	905	39	177
1·0040	052	1·0090	356	1·0140	649	1·0190	931	1·0240	202
41	078	91	382	41	675	91	956	41	227
42	104	92	408	42	701	92	982	42	252
43	131	93	434	43	727	93	5·008	43	278
44	157	94	460	44	752	94	033	44	302
45	183	95	486	45	778	95	059	45	328
46	209	96	512	46	804	96	081	46	353
47	235	97	538	47	830	97	109	47	379
48	261	98	564	48	856	98	135	48	401
49	287	99	590	49	881	99	160	49	429

TABLE LXXVIIIH.—*continued.*

Specific Gravity at 15° C.	Weight of Extract per cent.	Specific Gravity at 15° C.	Weight of Extract per cent.	Specific Gravity at 15° C.	Weight of Extract per cent.	Specific Gravity at 15° C.	Weight of Extract per cent.	Specific Gravity at 15° C.	Weight of Extract per cent.
1·0250	6·455	1·0310	7·965	1·0370	9·458	1·0430	10·936	1·0490	12·400
51	480	11	990	71	483	31	961	91	425
52	505	12	8·015	72	507	32	985	92	449
53	530	13	040	73	532	33	11·010	93	473
54	556	14	065	74	557	34	034	94	497
55	581	15	090	75	582	35	059	95	522
56	606	16	115	76	606	36	083	96	546
57	631	17	140	77	631	37	108	97	570
58	657	18	165	78	656	38	132	98	595
59	682	19	190	79	681	39	157	99	619
1·0260	707	1·0320	214	1·0380	705	1·0440	181	1·0500	643
61	732	21	239	81	730	41	205	01	668
62	758	22	264	82	755	42	230	02	692
63	783	23	289	83	780	43	254	03	716
64	808	24	314	84	804	44	279	04	740
65	833	25	339	85	829	45	303	05	765
66	859	26	364	86	854	46	328	06	789
67	884	27	389	87	879	47	352	07	813
68	909	28	414	88	903	48	377	08	837
69	934	29	439	89	928	49	401	09	862
1·0270	960	1·0330	464	1·0390	953	1·0450	426	1·0510	886
71	985	31	489	91	978	51	450	11	910
72	7·010	32	514	92	10·002	52	474	12	935
73	035	33	539	93	027	53	499	13	959
74	060	34	564	94	052	54	523	14	983
75	085	35	589	95	076	55	548	15	13·007
76	111	36	613	96	101	56	572	16	031
77	136	37	638	97	125	57	597	17	056
78	161	38	663	98	150	58	621	18	080
79	186	39	688	99	174	59	646	19	104
1·0280	211	1·0340	713	1·0400	199	1·0460	670	1·0520	128
81	236	41	738	01	224	61	694	21	152
82	261	42	763	02	248	62	719	22	176
83	286	43	788	03	273	63	743	23	200
84	311	44	813	04	297	64	768	24	224
85	337	45	838	05	322	65	792	25	248
86	362	46	863	06	346	66	817	26	272
87	387	47	888	07	371	67	841	27	296
88	412	48	913	08	396	68	866	28	321
89	437	49	938	09	420	69	890	29	345
1·0290	462	1·0350	963	1·0410	445	1·0470	915	1·0530	369
91	487	51	987	11	469	71	939	31	393
92	512	52	9·012	12	494	72	963	32	417
93	538	53	037	13	518	73	988	33	441
94	563	54	062	14	543	74	12·012	34	465
95	588	55	087	15	568	75	037	35	489
96	613	56	111	16	592	76	061	36	513
97	638	57	136	17	617	77	085	37	537
98	663	58	161	18	641	78	109	38	561
99	688	59	185	19	666	79	134	39	586
1·0300	713	1·0360	210	1·0420	690	1·0480	158	1·0540	610
01	739	61	235	21	715	81	182	41	634
02	764	62	260	22	740	82	206	42	658
03	789	63	285	23	764	83	231	43	682
04	814	64	309	24	789	84	255	44	706
05	839	65	334	25	813	85	279	45	730
06	864	66	359	26	838	86	304	46	754
07	889	67	384	27	862	87	328	47	778
08	914	68	408	28	887	88	352	48	802
09	940	69	433	29	902	89	376	49	827

TABLE LXXVIIIb.—*continued.*

Specific Gravity at 15° C.	Weight of Extract per cent.	Specific Gravity at 15° C.	Weight of Extract per cent.	Specific Gravity at 15° C.	Weight of Extract per cent.	Specific Gravity at 15° C.	Weight of Extract per cent.	Specific Gravity at 15° C.	Weight of Extract per cent.
1·0550	13·851	1·0600	15·048	1·0650	16·234	1·0700	17·411	1·0750	18·581
51	875	01	071	51	257	01	434	51	604
52	899	02	095	52	281	02	458	52	627
53	923	03	119	53	304	03	481	53	651
54	947	04	143	54	328	04	505	54	674
55	971	05	166	55	352	05	528	55	697
56	995	06	190	56	375	06	552	56	720
57	14·019	07	214	57	399	07	575	57	743
58	043	08	238	58	422	08	599	58	767
59	067	09	261	59	446	09	622	59	790
1·0560	091	1·0610	285	1·0660	470	1·0710	646	1·0760	814
61	115	11	309	61	493	11	669	61	837
62	139	12	333	62	517	12	693	62	860
63	163	13	356	63	540	13	716	63	884
64	187	14	380	64	564	14	740	64	907
65	211	15	404	65	587	15	763	65	930
66	235	16	428	66	611	16	787	66	954
67	258	17	451	67	635	17	810	67	977
68	282	18	475	68	658	18	834	68	19·000
69	306	19	499	69	682	19	857	69	023
1·0570	330	1·0620	523	1·0670	705	1·0720	880	1·0770	046
71	354	21	546	71	729	21	904		
72	378	22	570	72	752	22	927		
73	402	23	594	73	776	23	951		
74	426	24	618	74	800	24	974		
75	450	25	641	75	823	25	998		
76	474	26	665	76	847	26	18·021		
77	498	27	689	77	870	27	044		
78	522	28	713	78	894	28	068		
79	546	29	737	79	918	29	091		
1·0580	569	1·0630	760	1·0680	941	1·0730	114		
81	593	31	784	81	965	31	138		
82	617	32	808	82	988	32	161		
83	641	33	832	83	17·012	33	184		
84	665	34	855	84	035	34	208		
85	689	35	879	85	059	35	231		
86	713	36	903	86	082	36	254		
87	737	37	926	87	106	37	278		
88	761	38	950	88	129	38	301		
89	785	39	974	89	153	39	324		
1·0590	809	1·0640	998	1·0690	176	1·0740	348		
91	833	41	16·021	91	200	41	371		
92	857	42	045	92	223	42	394		
93	881	43	069	93	247	43	417		
94	904	44	092	94	270	44	441		
95	928	45	116	95	294	45	464		
96	952	46	139	96	317	46	487		
97	976	47	163	97	341	47	511		
98	15·000	48	186	98	364	48	534		
99	024	49	210	99	388	49	557		

SUPPLEMENTARY TABLES.

WEIGHTS AND MEASURES.

The relative values of metric and imperial units are now legally fixed by "Orders Council," and Regulations issued by the Board of Trade. These are based on careful cor parisons of the standard yard, standard metre, etc., and they differ considerably from tl older determinations on which the tables on pages 48–53 of Vol. I. were based. Tl following are extracted from the Regulations of the Board of Trade, dated Mar 1907:—

"The **Metre** is the length, at the temperature of 0° C., of the iridio-platinum ba numbered 16, deposited with the Board of Trade."

"The **Kilogram** is represented by the iridio-platinum weight, numbered 18, deposit with the Board of Trade."

"The **Litre** is represented by the capacity at 0° C. of the cylindrical brass measur marked 'Litre, 1897' (which is deposited with the Board of Trade)."

"The **Yard** is the length at 62° Fahr., marked on a bronze bar deposited with tl Board of Trade."

"The **Pound** is the weight of a piece of platinum weighed in vacuo at 0° C., which deposited with the Board of Trade."

"The **Gallon** contains 10 lbs. weight of distilled water weighed in air against bra weights, with the water and the air at the temperature of 62° Fahr., the barometer bei at 30 inches."

The fundamental equivalents are given as follows:—

1 Metre (m.)	39·370113 inches.
1 Kilogramme	15432·3564 grains.
1 Gallon	4·5459631 litres.

From these legalised equivalents the following tables have been carefully calculated:—

Linear Measures.

Imperial Linear Measures.

	Equivalent in Metres.	Log. of Equivalent.
1 inch	0·025400	$\bar{2}$·4048333
1 foot, 12 ins., . . .	·304800	$\bar{1}$·4840146
1 yard, 3 ft., . . .	·914399	$\bar{1}$·9611358
1 pole, 5½ yds., . .	5·029196	0·7014985
1 furlong, 40 pls., . .	201·167825	2·3035585
1 mile, 8 fs., . . .	1609·342600	3·2066585
1 link, 7·92 ins., . .	0·201168	$\bar{1}$·3035585
1 chain, 100 links, .	20·116782	1·3035585

Metric Linear Measures.

	Equivalent in Imperial Units.	Log. of Equivalent
1 millimetre, . .	0·039370 in.	$\bar{2}$·5951667
1 centimetre, .	·393701 ,,	$\bar{1}$·5951667
1 metre, . . .	39·370113 ,,	1·5951667
,, . . .	3·28084275 ft.	0·5159854
,, . . .	1·09361425 yds.	0·0388642
1 kilometre, . .	1093·61425 yds.	3·0388642
,, . .	0·62137173 mile*	$\bar{1}$·7933515

SUPERFICIAL MEASURES.

Imperial Superficial Measures.

	Equivalent in Imperial Units.	Log. of Equivalent
1 square inch, ...	6·45158877 cm.^{2}	0·8096667
1 square foot, 144 sq. ins., . .	929·02878312 ,,	2·9680292
1 square yard, 9 sq. ft., . .	8361·25904806 ,,	3·9222717
1 acre, 4840 sq. yds., . .	4046·84937926 m.^{2}	3·6071170
,, ,, . .	40·46849379 ares	1·6071170
1 square chain, ...	404·68493793 m.^{2}	2·6071170
,, ...	4·04684938 ares	0·6071170
1 square mile, 640 acres, . .	2589983·60272657 m.^{2}	6·4132970
,, ,, . .	25899·83602727 ares	4·4132970
,, ,, . .	258·99836027 hectares	2·4132970
,, ,, . .	2·58998360 km.^{2}	0·4132970

Metric Superficial Measures.

	Equivalent in Imperial Units.	Log. of Equivalent.
1 square millimetre, . .	0·0015500 sq. in.	$\bar{3}$·1903333
1 ,, centimetre, . .	·1550006 ,,	$\bar{1}$·1903333
1 ,, decimetre, . .	15·5000580 ,,	1·1903333
1 ,, metre, . .	1550·0057976 ,,	3·1903333
1 ,, ,, . .	10·7639292 sq. ft.	1·0319708
1 ,, ,, . .	1·1959921 sq. yds.	0·0777283
1 are, ...	119·5992128 ,,	2·0777283
1 hectare, . . .	2·4710581 acres	0·3928830
1 square kilometre, . .	0·3861028 sq. m.	$\bar{1}$·5867030

Cubic Measures.

Imperial Cubic Measures.

	Equivalent in Metric Units.	Log. of Equivalent.
1 cubic inch, . . .	16·38702122 cm.^{3}	1·2145000
1 cubic foot, 1728 in.^{3}, .	28316·77266817 ,,	4·4520438
1 cubic yard, 27 ft.^{3}, .	0·76455286 m.^{3}	$\bar{1}$·8834075

Metric Cubic Measures.

	Equivalent in Imperial Units.	Log. of Equivalent.
1 centimetre cube, . .	0·06102390 c. in.	$\bar{2}$·7855000
1 decimetre cube, . .	61·02390340 ,,	1·7855000
1 stere or metre cube, .	61023·90340346 ,,	4·7855000
,, ,, . .	35·31475891 c. ft.	1·5479562
,, ,, . .	1·30795403 c. yds.	0·1165925

Measures of Capacity.

Imperial Measures of Capacity.

	Equivalent in Metric Units.	Log. of Equivalent.
1 gill, 5 fl. oz., . . .	0·1420613 litres	$\bar{1}$·1524759
1 pint, 4 gills, 20 fl. ozs. .	·5682451 ,,	$\bar{1}$·7545359
1 gallon, 8 pints, . .	4·5459631 ,,	0·6576259
1 peck, 2 gals., . .	9·0919262 ,,	0·9586559
1 bushel, 4 pecks, . .	36·3677048 ,,	1·5607159
1 quarter, 8 bush., . .	290·9416384 ,,	2·4638059
1 fluid ounce, ...	2·8412269 centilitres	0·4535059
1 fluid drachm (60 minims),	3·5515337 millilitres	0·5504159
1 fluid scruple, . . .	1·1838446 ,,	0·0732947
1 minim, ...	0·0591922 ,,	2·7722647

Metric Measures of Capacity.

	Equivalent in Imperial Units.	Log. of Equivalent.
1 centilitre, . . .	0·07039212 gills	$\bar{2}$·8475241
1 decilitre, . . .	0·70392124 ,,	$\bar{1}$·8475241
1 litre, ...	7·03921244 ,,	0·8475241
,, ...	1·75980311 pints	0·2454641
,, ...	0·21997539 gal.	$\bar{1}$·3423741
1 dekalitre, . . .	17·59803110 pints	1·2454641
,, . . .	2·19975389 gals.	0·3423741
,, . . .	1·09987694 peck	0·0413441
1 hectolitre, . . .	21·99753887 gals.	1·3423741
,, . . .	2·74969236 bush.	0·4392841

MEASURES OF WEIGHT.

Imperial Measures of Weight.

	Equivalent in Metric Units.	Log. of Equivalent.
1 grain, ...	0·064799 grm.	$\bar{2}$·8115678
1 dram (avoir.), .	1·771845 ,,	0·2484258
1 ounce ,, . .	28·349527 ,,	1·4525458
1 pound ,, . .	453·592427 ,,	2·6566658
1 stone ,, . .	6·350294 kgms.	0·8027938
1 quarter ,, . .	12·700588 ,,	1·1038238
1 hundredweight ,, . .	50·802352 ,,	1·7058838
1 ton ,, . .	1016·047037 ,,	3·0069138
,, ,, . .	1·016047 tonnes	0·0069138
1 pennyweight (troy), .	1·555174 grms.	0·1917790
1 scruple (apoth.), . .	1·295978 ,,	0·1125978
1 drachm (,,), . .	3·887935 ,,	0·5897190
1 ounce (troy and ap.), .	31·103481 ,,	1·4928090
1 pound (,, ,,), .	373·241769 ,,	2·5719903

Metric Measures of Weight.

	Equivalent in Imperial Units.	Log. of Equivalent.
1 milligramme, . .	0·0154324 grain	$\bar{2}$·1884322
1 centigramme, . .	0·1543236 ,,	$\bar{1}$·1884322
1 decigramme, . . .	1·5432356 ,,	0·1884322
1 gramme, . . .	15·4323564 ,,	1·1884322
1 dekagramme, . .	5·6438332 drms. (av.)	0·7515742
1 hectogramme, . .	3·5273957 oz. (,,)	0·5474542
1 kilogramme, . .	15432·3564 grains	4·1884322
,, . . .	2·2046223 lbs.	0·3433342
1 myriagramme, . .	22·0462234 ,,	1·3433342
1 quintal, . . .	1·9684128 cwt.	0·2941162
1 tonne, ...	0·9842064 ton	$\bar{1}$·9930862

Volume and Mass of Water.

Recent investigations seem to indicate that the values accepted by the Inte Conference in 1900 (given on page 1183 *ante*) are slightly erroneous: the values sidered most reliable are—

Mass of 1 cm.^{3} of pure water at 4° C. = 0·999972 grm.
Volume of 1 grm. of pure water at 4° C. = 1·000028 cm.^{3}

The following table has therefore to be substituted for Table XLIa., in volume of this work :—

Volume and Density of Water between − 10° C. and 100° C.

Temperatures according to Standard Mercury Thermometer.

The following table has been calculated on the assumption that the *relative* de water as given in Table XLIa. are fairly correct although the absolute densitie wrong :—

Temperature.	Weight of 1 cm.^{3} in grms.	Vol. of 1 grm. in cm.^{3}	Temperature.	Weight of 1 cm.^{3} in grms.	Vol. o in
− 10° C.	0·99812	1·00189	20° C.	0·998224	1·00
− 9	99840	00160	21	998014	00
− 8	99866	00133	22	997793	00
− 7	99889	00111	23	997562	00
− 6	99909	00091	24	997321	00
− 5	99927	00073	25	997062	00
− 4	99942	00058	26	996809	00
− 3	99955	00015	27	996539	00
− 2	99967	00031	28	996260	00
− 1	99976	00024	29	995973	00
0	999846	000155	30	995677	00
+ 1	999902	000099	31	995373	00
2	999942	000058	32	995059	00
3	999963	000035	33	994737	00
4	999972	000028	34	994408	00
5	999964	000036	35	994070	00
6	999942	000058	36	99369	00
7	999904	000096	37	99331	00
8	999853	000147	38	99300	00
9	999787	000213	39	99265	00
10	999708	000293	40	99230	00
11	999615	000386	41	99192	00
12	999509	000492	42	99154	00
13	999390	000611	43	99114	00
14	999259	000742	44	99074	00
15	999115	000885	45	99032	00
16	998960	001041	46	98990	0
17	998793	001209	47	98946	0
18	998614	001388	48	98902	0
19	998424	001578	49	98857	0

Volume and Density of Water—*continued.*

Temperature.	Weight of 1 cm.³ in grms.	Vol. of 1 grm. in cm.³	Temperature.	Weight of 1 cm.³ in grms.	Vol. of 1 grm. in cm.³
50° C.	0·98810	1·01204	76° C.	0·97432	1·02635
51	98764	01252	77	97372	02699
52	98718	01299	78	97311	02764
53	98671	01347	79	97250	02828
54	98624	01396	80	97188	02893
55	98576	01445	81	97126	02959
56	98527	01495	82	97063	03025
57	98478	01545	83	97001	03092
58	98429	01596	84	96938	03159
59	98379	01648	85	96873	03227
60	98328	01700	86	96809	03296
61	98277	01753	87	96744	03366
62	98225	01807	88	96679	03435
63	98172	01862	89	96613	03506
64	98118	01918	90	96547	03577
65	98064	01974	91	96480	03648
66	98009	02031	92	96413	03721
67	97954	02089	93	96345	03793
68	97899	02146	94	96277	03867
60	97843	02204	95	96209	03941
70	97787	02263	96	96140	04015
71	97730	02323	97	96071	04090
72	97671	02384	98	96002	04165
73	97612	02446	99	95931	04241
74	97552	02509	100	95860	04318
75	97492	02572			

Taking the legalised value for the metre (= 39·370113 in.) we get:

1 foot cube = 28316·772668 cm.³

and, taking the weight in vacuo at 4° C. of 1 cm.³ of water to be 0·999972 grm., we get the weight of a foot cube of water in vacuo at 4° C. to be

28315·979799 grms.

or 62·42604172 lbs. avoirdupois.

This gives the weight in vacuo at 62° F. of 1 foot cube of water as

62·3558124 lbs.

And the apparent weight against brass weights in air at 62° F. with the barometer at 30 inches is

62·288693 lbs. very nearly.

The volume of water which, weighed against brass weights in air at 62° F. under a barometric pressure of 30 inches (ice-cold), has in London an apparent weight of 10 lbs., works out as

277·4179 cubic inches.

With a barometric pressure of 30 inches of mercury at 62° F. the volume would be as nearly as possible 277·4202 cubic inches.

A cubic inch of water at 4° C. in vacuo weighs

252·88327 grains.

By these enactments all metric standards become empirical, and the ideal connection between the metre, litre, and gramme disappears: an imperial litre is practically 1000·16 $cm.^3$ For practical purposes we may still assume that

1 litre = 1 decimetre cube,

and that 1 litre of water at 4° C. weighs 1 kilogramme.

Accepting 0·806286 as the specific gravity of absolute alcohol, 0°/4° C. (see page 1184), we get the

Mass of 1 $cm.^3$ of Absolute Alcohol at ° C. = 0·80626342 grms.
Mass of 1 cubic inch of Absolute Alcohol at 32° F. = 203·896241 grains.

Taking the most probable meaning of the legal definition of a gallon—*i.e.* that "at the temperature of 62° F., the barometer being at 30 inches," means at 30 inches of mercury at 62° F. and not 30 inches of ice-cold mercury—we get the

Capacity of the Imperial Gallon = 277·4202 cubic inches,

and 277·4202 cubic inches of ice-cold absolute alcohol would weigh

56564·936 grains.
8·080705 lbs. avoirdupois.

INDEX.

Method :—Where a table is devoted to one or two substances only, it is indexed under the substances and also under properties tabulated (viz. "Boiling Point," "Solubility," or such); where, however, table includes a large number of substances, it is indexed under property, and, where possible, the substances are grouped (viz. "Nitrates," "Acids, inorganic").
For greater convenience, volume is indicated before page number.